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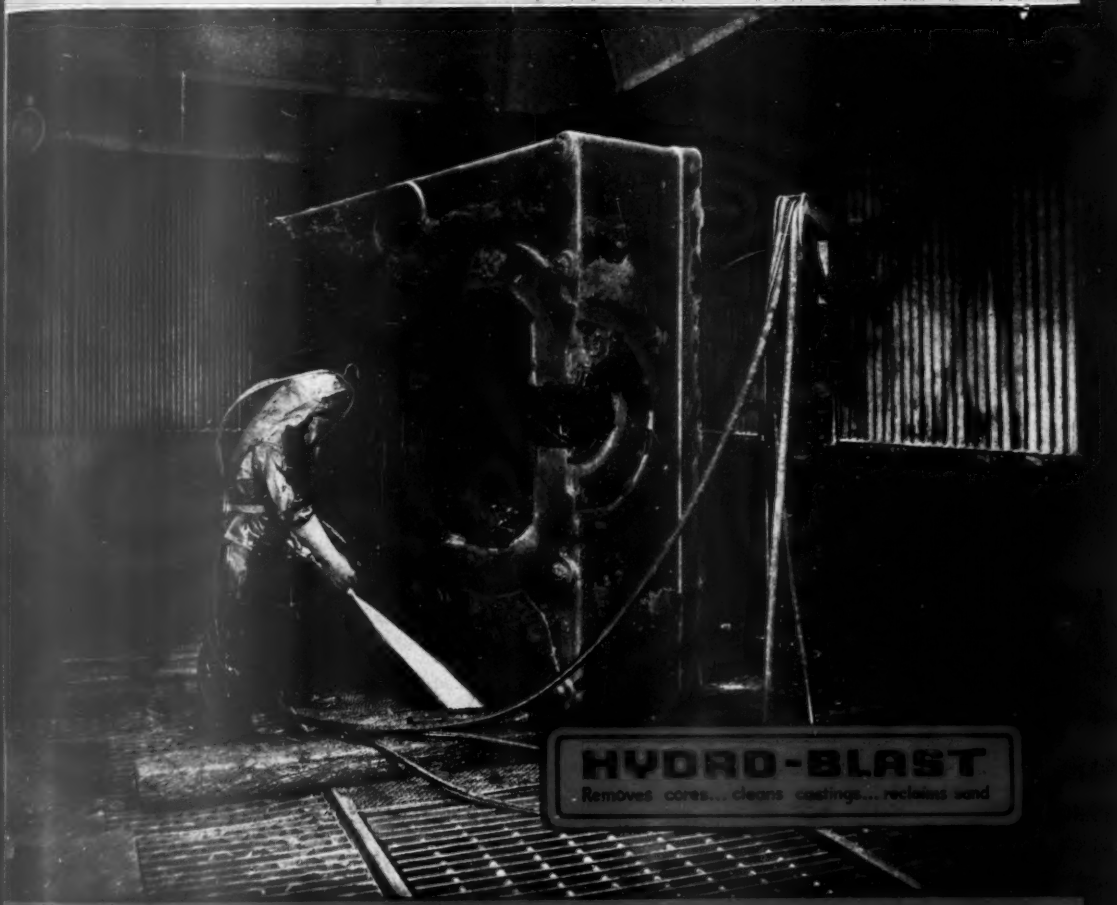

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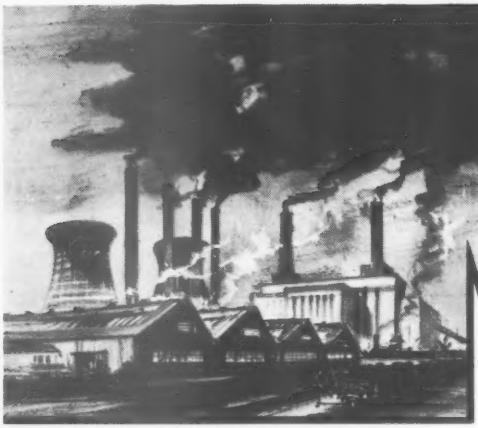

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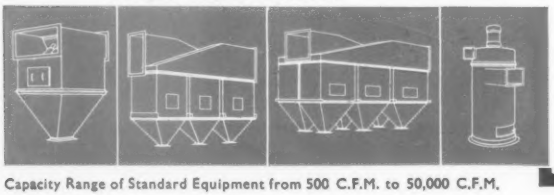

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Coal and Foundry Costs

It is a *sine qua non* that the foundry is, as is indicated by its name, a fundamental industry; yet to-day this significance is losing something of its force, because its major section relies on coal derivatives—coke and pig-iron—as its staple raw material. For a fortnight founders have been required to pay much higher prices for coke. This increase follows rapidly on the recent advance in the cost of pig-iron. Both are due to the same basic factor—the increase in the pit-head charges for coal. This reliance on coal is causing much misgiving, as prices are constantly rising. In the mines, productivity is making no progress and the quality of the output is being lowered. The engineering industries are well aware of this, but do they yet realize that even the efficient steel and foundry concerns must ask more money for their products and in their turn must demand higher prices for the goods they export ?

Iron, steel, foundry and the engineering industries have made commendable progress since the last war but, with all the good will in the world, we fail to see a corresponding effort made by the coal-mining monopoly. Money has been poured into pit mechanization, but with no commensurate increase in production per man-year. Yet it is this last factor which is of prime importance. The situation is so appalling, that ever-increasing attention is being given to atomic power and oil fuel as an alternative. The steel works and glass industries are placing increasing reliance on oil fuel, which raises the query as to what similar steps are possible for the ferrous foundries, as there seems to be no end to the ever-increasing demands for higher prices for coal.

For pig-iron and scrap, the situation cannot very well change, but we are not so sure about coke as the main source of heat. Admittedly, there is still much to be done in the direction of making the cupola more efficient by such methods as the use of hot blast and so forth. Still, it should not be beyond the wit of British furnace designers to create a really efficient oil-fired furnace to replace the cupola. Indeed, at the moment, it is more than possible that a detailed study of the costs involved in the production of molten iron from rotary, oil-fuel-fired furnaces might reveal that they are equal or lower than those to be associated with the cupola. The advantage which is lost is that such furnaces do not give a continuous supply of metal. A final speculation is that it has been reliably stated that very large electric furnaces can produce liquid steel as cheaply as the conventional open-hearth. Whether the installation of an outsize plant for the largest of our foundries could yield economic costs will take much time to determine, but every increase in the pit-head prices of coal brings this and similar notions more into the realm of realities.

W. T. HOBKIRK

President of the Association of Bronze & Brass Founders.

Leaders of the Industry

W. T. HOBKIRK

THIS year's president of the Association of Bronze & Brass Founders, Mr. W. T. Hobkirk, C.C., J.P., is a founder member and now chairman of J. Hobkirk, Sons & Company, Limited, patternmakers, iron and non-ferrous founders, and engineers, of Bedford. He was elected president of the Association at the annual meeting in London in April, after having served as vice-president during the past year. Mr. Hobkirk is chairman of the main advisory committee which is responsible for administering the Conditional Aid Scheme in the brassfounding industry.

Before starting, jointly with his father—the late Mr. J. T. Hobkirk—the company which bears their name, Mr. W. T. Hobkirk was an engineering apprentice and served as a trooper in the Bedfordshire Yeomanry during the first world war and later as an engine-room artificer in the Royal Navy. During the more recent war, Mr. Hobkirk held a commission in the Home Guard and was chairman of the Bedford district committee of the Eastern Regional Board, Ministry of Production.

For many years, Mr. Hobkirk has taken an active part in the work of the trade associations connected with the engineering industry and early this year he was elected chairman of the South of England Ironfounders' Association. During past years he has served on the joint founding committee of the Engineering and Allied Employers Federation and is a member of the joint standing committee on "Conditions in Non-ferrous Foundries."

In addition to his work in the foundry industry, Mr. Hobkirk finds time to play a prominent part in local government and since 1949 has been a member of the Bedfordshire County Council. He was appointed a Justice of the Peace last year and is prominently associated with many organizations in the Bedford and Kempston district.

Congress Paper Author

Mr. L. Fletcher, who presented the Paper, "Recent Aluminium Casting Developments," printed on page 115 of this issue, did so on behalf of the Technical Committee (of which he is Chairman) of the Light Metal Founders' Association. He has held the post of manager of the Birmingham factory of the Northern Aluminium Company, Limited, since 1937, and has been in the aluminium industry for some 36 years. For 30 years he has been associated with his present company. He is vice-chairman of the Light Metal Founders' Association and a governor of the National Foundry College.

Indigenous Sulphur Supplies

New Anhydrite Mine

A new anhydrite mine has recently been opened at Sandwith, near Whitehaven, on the west coast of Cumberland, on what are claimed to be the richest and most extensive seams of anhydrite in Britain. This mineral is one of the raw materials from which sulphuric acid and cement are manufactured. Because of apparently dwindling sulphur resources in the United States in 1951, the United States Government seriously restricted exports and since the United Kingdom was dependent upon American elemental sulphur for half its sulphuric-acid production, the British Government initiated an investment programme to make greater use of indigenous raw materials such as anhydrite in sulphuric acid manufacture. Marchon Products, Limited, chemical manufacturers, located deposits of anhydrite in the vicinity of their Whitehaven factory and decided to build a sulphuric acid and cement plant using the mined anhydrite as the raw material. To do this, a new company—Solway Chemicals, Limited, was formed, Marchon Products, Limited, retaining the controlling interest.

The mine has been designed to produce 7,000 tons of anhydrite every week and when the new plant is in full operation at the end of the year, it is estimated that at least 90,000 tons of sulphuric acid, and a similar quantity of cement, will be manufactured annually. Deposits at Whitehaven are so vast that supplies are expected to last for several hundred years. Inside the mine the pillar-and-stall method of extracting is used, only 60 per cent. of the mineral being taken, the remaining 40 per cent. being left as pillars to ensure that there shall be no disturbance of the surface above the workings. The mine is already producing about 4,000 tons a week.

The power supplies to the electrical equipment of the mine have made necessary the installation of nearly 5,000 yds. of 660-v. and 3,300-v. cable to supply the conveyor heads and transformers, and 1,200 yds. of 660-v. cable for supply and lighting in the brake-house which controls the movement of railway wagons to and from the mine. Electric rotary drills, mounted on caterpillar track carriages, are supplied with current *via* 1,050 yds. of 91/.018-in. trailing cable. All these cables, together with plastic types for use in the new chemical plant, and H.D. cadmium-copper wire for signalling purposes in the mine, were provided by British Insulated power factor correction.

Views on Automation

Speaking at the Birmingham Exchange and Engineering Centre on July 14, Mr. Frank B. Woollard warned industrialists itching to convert factories to automation, to look before they leap. The successful application of automation rested mainly on planning—in fact, super planning—but at the same time sight must not be lost of simple economics, Mr. Woollard said. There were some jobs which just did not lend themselves to automatic production.

Too much had been made of automation in some sections of the Press, he suggested. Some regarded it as a threat to human rights; some thought it was a weapon against the workers; some saw civilization doomed to a strait-jacket existence through regularization. In fact, it was liable to be a grossly inflated issue. The completely automatic workshop was plausible and would probably be with us within the next ten years but it was likely that the complete automation factory would never be seen; it was theoretically possible, but that did not mean it was economically practicable. What was to be gained by automation, Mr. Woollard queried. It entailed four times as much supervisory labour; it freed 40 per cent. of floor space; there was a much lower inventory of work in progress; there was much greater control of processing; there was much fuller utilization of machine capacity, and there was much greater safety for personnel.

Questioned about the possibility of unemployment through the introduction of automation, Mr. Woollard said that at the Austin Motor Company, automatic production instead of causing redundancy had led to 1,000 more workers being recruited and that was a good indication of cause and effect.

Foundrymen Through Five Generations

Edward Whitehouse sat in his house on Thursday, July 21, and pointed proudly to a plaque on the wall. It read: "Presented to Edward Whitehouse . . . in recognition of more than 100 years of continuous and faithful service by five generations of his family." His grandfather and father before him, and his son and grandson after him have worked at the Coneyere Foundry, Limited, in Tipton.

Now 67-years-old Edward, has finished his contribution to that record. He retired on July 22 after 50 years' unbroken service with the firm. Edward was a broad-shouldered young man when his father asked for a job for him at 18s. per week.

After that he just went on working, working, and never found it in any way monotonous. He should have retired two years ago, but stayed on hoping to reach his 50 years with the firm. The staff at the foundry have presented him with an armchair on his retirement.

Latest Foundry Statistics

Ministry of Supply statistics for light metals reveal that in May 1,910 tons of aluminium sand castings, 4,570 tons and 1,449 tons, respectively, of gravity-die- and pressure-die-castings were despatched. The cumulative totals for the first five months of the year are 9,260, 21,622 and 7,402 tons. Of magnesium-alloy castings, 44 tons were despatched in May and 302 tons in the five-month period.

Recent Aluminium Casting Developments*

Paper presented by L. Fletcher on behalf of the Light Metal Founders' Association, through the Aluminium Development Association.

This Paper concentrates attention on the effects of two main streams of development: (a) of aluminium alloys having special casting characteristics (b) of certain foundry and fabrication techniques. It is noted that the successful entry of aluminium castings into fields traditionally held by other metals has been based on the adaptability of the metal for sound and economic casting, or for its advantages in fabrication and service—but usually on both factors. The characteristics of the aluminium/10 per cent. magnesium casting alloy LM10 (BS 1490) are described in view of its emergence from principally aircraft applications into general use over a considerable range. Case histories illustrate the width and diversity of application for all aluminium castings, and the examples quoted include a number recently made by special techiques or new processes. Emphasis is placed on the flexibility of the gravity-die-casting (permanent-mould casting, in America) process, and on the influence of argon-arc welding developments in facilitating the use of relatively small cast sub-components for assembly into complex and often bulky products difficult or impossible to cast in one piece or to join by any other method.

In a paper presented before the Institute of British Foundrymen at its conference in 1951, a contrast was made between the wealth of aluminium alloys at the disposal of the founder of to-day with the one or two available to his predecessor of 50 years earlier. It was pointed out that this wider choice involves the founder in wider knowledge of his alloys, not only of their suitability for production by different methods, but of their fitness for the customer's requirements. Thus it was implied that the responsibility for a successful product rests not only with the founder but also with the designer or engineer on the customer's side; for he alone knows, even before the founder sees the order, what performance he expects from the product and under what conditions of service.

This implication of shared responsibility was developed and emphasized on a most appropriate occasion—founders, fabricators and users having met to exchange views—the following year.† Members of the Institute who took part in that discussion may recall the interest of users in descriptions of specific castings, which showed the designer how the founder approached and solved their joint problems. By a similar method, the present contribution indicates, very briefly, the range and diversity of products which are nowadays required as aluminium castings, and describes a few examples having some feature of particular interest to the foundryman.

Range of Aluminium Cast Products

The range of castings in aluminium has widened enormously over the years, and examples very often represent successful competition with what are termed "traditional" materials. Rainwater goods, for instance, were at one time chiefly made of cast iron. Aluminium alloys entered this field and now compete very favourably with cast iron, offering many advantages to offset the higher initial cost. Ease of handling, reduction of transport costs, the need for less maintenance, such as painting (as aluminium forms its own protective coating), ease of fabrication where non-standard lengths and shapes are required, are among these advantages.

In the textile industry, until recent years, wood was almost unchallenged as the material for bobbins, spindles, etc. These have now been successfully manufactured in aluminium and magnesium alloys and it is fair to say that in respect of such items the industry is being almost completely re-equipped with light-metal components. The advantages of durability, adaptability, higher working speeds and versatility are keenly appreciated. The ability to colour-anodise aluminium has enabled easy reference to be made to the type of yarn or process to which the material is being subjected.

Aluminium has entered the bearing field in competition with white-metal bearings, and it has been shown capable of withstanding higher loading than the white metals. It has the further advantage that if failure does occur, it has no deleterious effects on the shaft. The aluminium base is capable of taking up any debris in its surface, which would otherwise give rise to scoring of the shaft, and thus as well as having a longer life than the white metals at a higher loading, its use prolongs the life of the shaft. Bearings in this material are used for such applications as rolling mills and some automotive engines.

Electrical Products

Light alloys have been able to compete successfully in the electrical industry with cast-iron for

* Presented at the fifty-second annual meeting of the Institute of British Foundrymen last June.

† "*Proceedings* at a symposium on Aluminium-Alloy Castings." November, 1952 (Aluminium Development Association).

FIG. 1.—*Four types of automobile steering gearboxes, produced as castings in BS 1490: LM 10—W alloy.*

such components as casings and some parts of contactor mechanisms. Some of these are particularly adaptable to the pressure-die-casting process with consequent speed of production, accurate dimensions and reduced machining. This particular field has been considerably exploited, mainly at the expense of cast-iron, and not only on the cost basis but also for corrosion resistance—implying the reduced necessity for surface treatment.

A case in point is the manufacture of rotors for fractional-horse-power electric motors where aluminium replaces the more expensive copper originally used for this purpose. To form the rotor, a pack of laminations stamped from soft iron-sheet is assembled on a spindle. Each of the laminations has a central hole for the spindle and a series of holes round the outside edge. The pack of laminations is located in a die on a pressure-die-casting machine and molten high-purity aluminium is forced through the holes in the laminations. This forms a series of continuous strips of aluminium through the laminations and these strips are also joined at each end by a ring of the aluminium. The runner is separated from the casting, which is then ready for machining.

Two examples from road transport will be quoted later, but a full list of aluminium parts would include clutch-housings, exhaust manifolds, crank-cases and many engine components. On steam railways, traditional materials die hard, and so far aluminium has been used mainly for decorative trim for the interior of passenger rolling stock. A number of these items can be produced as castings and one outstanding example is given later.

Dairy and Marine Applications

In the dairy industry, full advantage has been taken of the high polish to be obtained on aluminium alloys to compete successfully with the stainless steels. One-piece construction of such units as base-plates for milk-bottling machines, and the many components which go to make up an assembly, have reduced cost. The high resistance of aluminium to corrosion has obviated the necessity for protective surface-treatment and enables a pleasant, easily maintained, hygienic surface to be achieved with comparative ease. It would be impossible to go to any farm of appreciable size and not see aluminium used for milking buckets, milking machines, churns, and a host of other applications.

For marine use, the greatest scope for light alloys in the past has been through use of the wrought forms, particularly sheet and extruded material. Castings, however, are coming increasingly into their own. They are found in radar scanning-units, for chassis, turning gear and motor housings; as the main frames of gyro compasses, as casings of radio equipment and housings of electrical switchgear. Sidelights and steering wheels are made almost wholly as castings. Ventilation fittings, floodlights, sextants and many more instruments continue a long and growing list.

The most striking evidence of the spread of light alloys into the consumer field is seen in the home. Here it is used for cast hollow-ware, sink units, gas-stove components, washing machines, vacuum cleaners, door-handles—even the television set has its quota of aluminium parts. In the main, these have replaced cast-iron components. Many cooking appliances have been developed through the versatility of aluminium; dough mixers, mincers, bacon slicers, to quote only a few.

There is a whole range of miscellaneous products, such as portable tools, sewing machines, knitting machines, home printing presses, weaving looms, hair driers, lawn-mowers and other agricultural implements, and pressure-die-cast toys.

Alloy Developments

The development of alloys having good casting qualities has probably played an equal part in progress with the development of casting methods. Developments of particular alloys, with appropriate treatment and foundry techniques, have been reported to the Institute from timt to time and the composition and mechanical properties of 22 casting alloys are now covered by BS.1490: 1955 (new edition in preparation for early release) "Aluminium and Aluminium-alloy Ingots and Castings for General Engineering Purposes."

Among the following examples are two applications of an alloy which has come into prominence over recent years and therefore merits some consideration here. This alloy, LM10-W, combines high proof-stress, high tensile-strength and good ductility with exceptional resistance to both shock and corrosion. It is an aluminium/magnesium alloy containing between 9.5 and 11 per cent. of magnesium, and has been used for many highly-stressed parts which previously were produced in malleable iron. The development of gravity-die-castings in this alloy has enabled considerable reduction in weight of various structures without sacrificing mechanical properties, and has also proved of considerable economic value, because castings in LM10-W can be machined with greater rapidity than the malleable iron used before.

Aluminium/Magnesium LM10-W

This alloy was first developed and used for highly-stressed sand castings for the aircraft industry, and may therefore be better known under its original aircraft specification number, DTD.300. Because of its success in the aircraft field, the alloy has now been given permanent aircraft status under BS. L53, and it is due to its success as a sand casting that development in gravity-die-casting (" or permanent-mould " casting) for general engineering purposes has been encouraged.

The specified mechanical-test requirements in the chill-cast condition are: tensile strength—20 tons/per sq. in.; elongation—12 per cent. (on 2-in. gauge length). In practice, tests prove that tensile strengths of 22 tons/per sq. in. and over can be regularly obtained, with elongation figures of 15 to 18 per cent. The 0.1 per cent. proof-stress is about 11 tons/per sq. in. Brinell hardness is in the neighbourhood of 80, and the Izod impact strength about 16 ft.-lb. These typical figures are quoted as they complete the picture of a useful combination where severe stresses are expected. Fig. 1 illustrates four types of automobile steering gear-boxes which are being produced in this material, but there are many other similar applications for the alloy.

In the foundry a special technique has to be used in handling and casting the alloy, and care must be maintained to prevent contamination with other alloys. But once the foundry has learned the correct technique no great difficulties occur and the results, on appropriate applications, well justify the care taken.

Examples of Aluminium Casting

In selecting examples, it has been assumed that the founder is interested in all the factors which make for an increase in the flow of orders through his books and of metal through his foundry. Thus, there is a case to show how aluminium has stepped into an opening created by the limitations of another material, and, incidentally, brought the element of design into a comparatively free-and-easy use of material. Other descriptions illustrate rather the economic and technical aspects of design and production.

For example, one of the constant objectives of the engineering industry has been the simplification of its methods of production, and the most economic and flexible method for forming metals is by pouring molten metal into a refractory cavity of the desired shape. Because of this, the foundry industry is constantly being asked to produce castings of more uniform result, with smoother surface-finish and to greater dimensional accuracy. This need has been met by the development of a series of new techniques for the production of castings in light alloys, such as the plaster mould processes.

Again, although designers are nowadays co-operating more and more with the founders when preparing drawings for new projects, there are nevertheless many occasions when the component required presents a difficult, if not impossible task. The suitability of the majority of aluminium alloys for welding and the advent of the argon-arc process has provided a method of breaking down some types of components into constituent parts, and supplying the customer with the article in the desired form.

Luggage-rack Brackets

An application of particular interest, since good mechanical properties are required in addition to good appearance, is the luggage-rack support bracket shown in Fig. 2. These components were originally produced as sand castings in bronze but are now produced as gravity die castings in the high strength alloy BS. 1490 LM10-W (Fig. 3).

The advantages of using aluminium alloy-castings are a reduction in the deadweight of the rolling stock, improved appearance (the castings are polished and anodized natural colour) and also a reduction in the amount of finishing required. Another important advantage of the gravity-die-casting process is that the form of the castings may be maintained with sufficient accuracy without machining to enable them to match up to the

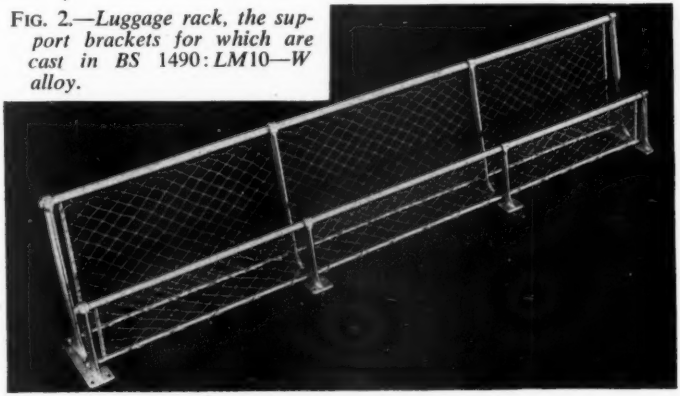


FIG. 2.—*Luggage rack, the support brackets for which are cast in BS* 1490: *LM*10—*W alloy.*

FIG. 3.—*Individual castings used for the luggage rack shown in Fig. 2.*

extruded aluminium-alloy sections which form the rack.

Conventional two-part gravity dies are used for the production of these castings. The important requirement for such equipment when used in conjunction with LM10 alloy is that it should work freely and that where possible provision should be made for ejecting the casting from the die. Ample fillet radii and draft angles are provided to minimize any tendency to the formation of contraction cracks during solidification. An interesting feature of the equipment producing the castings is that the left-hand, right-hand and centre brackets are all produced from the same die, appropriate change pieces being inserted to produce the necessary modifications.

After two to three years' service life, the castings are performing satisfactorily and have established the suitability of aluminium-alloy castings for this application. The weight saved per bracket is 3.5 lb., amounting to a saving of 280 lb. per coach.

Fire-hose Couplings

Components such as fire-hose couplings, normally produced as sand castings in bronze or gunmetal, are now being produced as gravity-die-castings in medium-strength aluminium alloys of good corrosion resistance. Advantages gained from the use of aluminium-alloy couplings are portability and weight saving, the latter enabling additional equipment to be carried on a fire tender. Moreover, these castings require the absolute minimum of finishing and the gravity-die process enables close tolerances to be maintained on the matching surfaces of the couplings. Figs. 4 and 5 illustrate the range of sizes and designs covered. The alloys commonly used for the manufacture of these castings are LM5-M, LM8-W and LM16-W.

Bearer Brackets for Lorries

The bearers for the lorry illustrated in Fig. 6 were originally simple beams of timber attached across the chassis, ready for either the truck body or the floor-boards. The shortage and the high cost of suitable timber forced the customer to look for alternative materials, and prototype sand castings in aluminium were then produced for development and test purposes.

The first prototypes were produced in the aluminium/silicon alloy LM6, but after prolonged tests (including driving a fully-loaded lorry round a test track for 300 miles), the alloy was changed to LM4 (solution treated). This is a more economic material for the purpose and was found capable of withstanding the load.

The original castings were mounted across a chassis of the flexible type, but eventually this was changed over to a method of mounting along the chassis members which proved perfectly satisfactory (Fig. 7). Minor modifications were made to the design of the two castings after the tests were completed, and production from then onwards consisted of gravity-die-castings. All bolt-holes are produced to size by the use of steel cores, and when castings are received by the customer, all that is necessary for him to do is to drop them into position and tighten the bolts. There is no machining what-

FIG. 4 AND 5.—*Groups of fire-hose coupling and similar castings for which alloys LM5—M; LM8—W and LM16—W are used.*

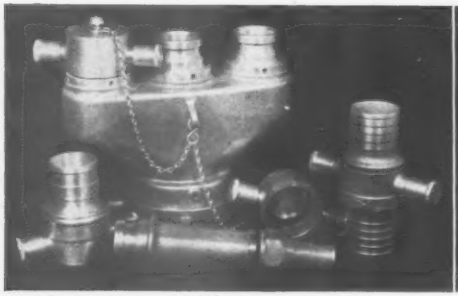


FIG. 6.—*Bearer bracket for a motor-lorry body, finally made in solution-treated LM 4 alloy.* (*Weight 16¼ lb.*).

soever, which is obviously a saving both in time and money and a very great advantage. This applies to the small castings also. Before being fitted the bearers are treated by the Aluchrome process, which gives a better surface for the retention of any finish that may be applied.

The bearer is 4 ft. 2-in. long, 10½-in. high and 2-in. wide; it weighs 16 lb. 4 oz. The pedestal casting is 10-in. high by 4-in. wide and weighs 2 lb. 11 oz. The total weight of castings per truck is 54 lb. Since early 1947, many thousands of these castings have been put into service and have given perfectly satisfactory results.

Tyre Moulds

Figs. 8 and 9 present an example of the use of a special casting process to achieve a particular result. In this case, high dimensional accuracy and fine finish were required but design difficulties prevented the use of metal moulds and to attain the necessary finish by machining would have been laborious and costly. A plaster-mould process—of which there are several forms*—was therefore used.

Constant research into the reduction of noise in motor vehicles caused by "tyre hum" and resonance, has resulted in the evolution of extremely complicated tread patterns and the production of moulds to impress these patterns in the rubber by traditional methods is a long and costly business.

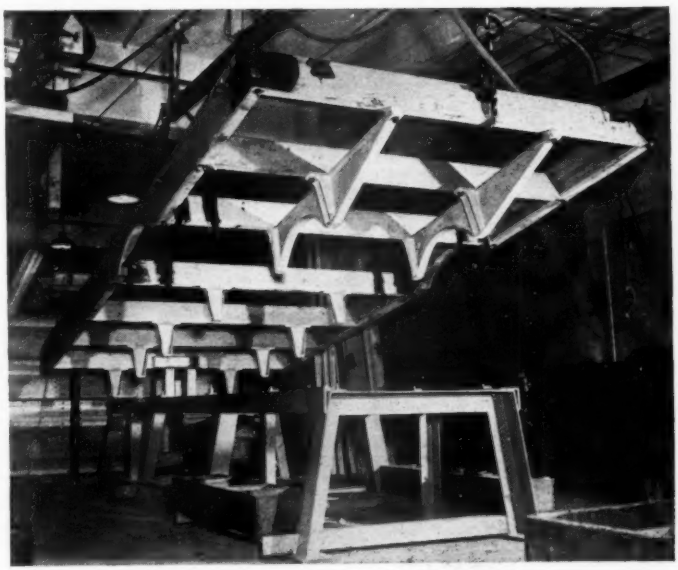
The traditional method of producing these tyre moulds is by machining or engraving the desired pattern on a blank shell or by lining a blank shell with accurately-fitting pressure-die-cast segments. By means of the plaster process a half-mould can be produced which needs no other finishing operations than the removal of the running and feeding arrangements and the machining of the joint face.

The vital step in the production of such a mould is the core assembly which forms the tread pattern, and this is built up from a series of plaster segments. A corebox, lined with a flexible plastic material, is used for the production of these segments, the resiliency of the plastic permitting the stripping of "undercut" shapes which could not be produced in a corebox of rigid construction.

After setting, the plaster segments are removed from the corebox and air-dried for a suitable period. The segments are then treated in an autoclave which produces a change in the crystal structure of the plaster. This treatment renders the plaster highly permeable without, however, altering the smooth skin finish. Finally, the segments are stoved at a suitable temperature to remove excess moisture.

The segments are assembled on a prepared platform and are then surrounded by a series of shaped plaster slabs to prevent contact between the aluminium assembly platform and the molten metal when the mould is poured. The side walls of the mould-cavity are built around the plaster core and are made of oil-bonded silica sand. These latter components embody the running and feeding arrangements. The general layout of the mould is shown in Fig. 8. It should be pointed out that the same finish as required on the tread form can be obtained on all parts of the casting by making the entire mould a plaster assembly.

Figure 9 shows a section of the finished half



* The "Antioch Process," developed in USA, is described here.

FIG. 7.—*Method of mounting the bearer brackets, as well as pedestal brackets, in the frame of the lorry.*

FIG. 8.—*General layout of the components for producing a tyre-mould casting.*

mould. Here the joint face has been machined, but the tread form is in the as-cast condition. The only dressing operation carried out on the tread form is the removal of the slight flash caused by the joints between the plaster segments.

The process enables such a tyre mould to be made with a variation of plus or minus 0.005 in. on the diameter and with a skin finish suitable for the production of a satisfactory tyre. The process is extremely flexible and has been extended to cover all types of intricate castings where high dimensional accuracy and superfine finish are the primary considerations. Typical examples of such castings are rotary torque-converters, small aircraft cabin-blowers and volute casings, and instrument components.

FIG. 9.—*Section of a finished half tyre-mould, having the joint face machined but the tread form as-cast.*

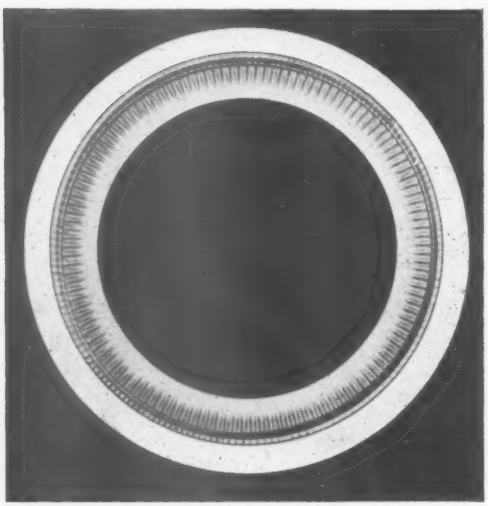


FIG. 10.—*Sectioned hollow-cylinder, diaphragm casting (centre) and its component gravity-die-castings.*

Hollow Cylinder with Centre Diaphragm

Basically, the component next to be described was a cylinder measuring about 13 in. long and 7 in. dia. with a diaphragm separating two roughly equal chambers which had to be pressure-tight in relation to each other and to the outside. The casting difficulties were complicated by several rather thick bosses on the diaphragm plate, and of course, any subsequent machining, involving drilling and tapping in addition to turning, would have been very difficult indeed.

FIG. 11.—*Argon-arc welding of the die-cast components shown in Fig. 10, after mounting in an electrically-rotated jig.*

Some prototypes were sand cast but the bulk were required as gravity-die-castings and it was eventually decided to make three separate castings which would then be machined and finally argon-arc welded together to form the finished component. A sectioned assembly, together with the separate die-castings, are shown in Fig. 10. The two sleeve portions were each cast with the diameter in a horizontal plane and fed from a gate at the side joint-line. For the parallel-sided sleeve, a ring riser was used on the flanged end and two inner cores met to form a small internal flange, one core being extracted downwards by rack and pinion, and the other lifted upwards, using levers. The other sleeve-portion was made with the tapered end downwards; a heavy runner into the casting at that area proved suitable for feeding purposes. Again, two cores were used to produce the bore. Aluminium/silicon alloy, BS 1490 LM6-M, was used and this proved very suitable for subsequent welding. During machining, the edges were chamfered on the two sleeves and these, together with the machined edge of the diaphragm, formed a V-groove to take the weld deposit.

The assembly jig was made rotatable (by electric drive) so that a continuous argon-arc welding operation could be effected (Fig. 11). The cleanliness of the final weld made further finishing unnecessary and subsequent micro-examination of sections of the weld showed it to be a structurally-sound junction. By producing this component in the manner described considerable saving was achieved. In particular, the scrap percentage was lower than would have been possible if the component had been produced as a one-piece casting.

Conclusion

The advances in foundry technique as applied to aluminium casting are reaping their reward in the size of castings successfully produced, which has increased considerably over the last five years. Complementary with this, the development of alloys with especially good casting characteristics has greatly widened the field for aluminium castings of all sizes and types, simple and complex—whether produced by sand casting, by gravity- or pressure-die casting, or by one of the more recent processes developed to solve particular problems. The effect of welding progress, in making possible the rapid, accurate and strong assembly of small castings into a large and possibly complex whole, has already been illustrated; it is reasonable to say that the possibilities of this assembly method are only beginning to be realized.

It is pertinent to make specific mention of the advantages of the gravity-die-casting process in producing a very wide range of components to close dimensional tolerances; also—because of the frequency with which they are incorporated in a design—to point to the facility of this method for coring small holes. When such advantages are coupled with the lower melting temperature of aluminium (and consequent comparative freedom from refractory troubles and lower fuel costs), the user can be satisfied that his article is produced under the most economic conditions, taking into account the skill and care necessary to produce it accurately and well.

The peak annual output of aluminium-alloy castings in the United Kingdom during the second world war was approximately 59,000 tons. To-day, the industry is producing at the rate of 90,000 tons a year, a sure indication that the purchasing and engineering sections of industry have taken full advantage of using a material which is relatively stable in price, enjoys a low weight to strength ratio, and can be mass-produced in the foundry.

Junior Engineers' Meeting

A meeting of junior engineers of the Iron and Steel Engineers' Group will be held at the offices of the Iron and Steel Institute, 4, Grosvenor Gardens, London, S.W.1, from Monday to Thursday, September 26-29. In the absence of Mr. W. M. Larke, chairman of the group, the Hon. R. G. Lyttelton, past-president of the Iron and Steel Institute, will be in the chair. The object of the meeting is to provide an opportunity for the younger engineers and operators in the iron and steel and associated industries to discuss engineering problems and visit works of interest. On the Monday afternoon, a lecture on "Corby Works of Stewarts and Lloyds, Limited," will be given by J. Daniel and D. Bird, and in the evening will be the presentation and discussion of the paper "Guides and Strippers for Rod and Bar Mills," by F. Starkey of Buckley & Taylor, Limited. On Tuesday, an all-day visit to the Ford Motor Company, Limited, Dagenham, will be the principal item, followed on Wednesday by an all-day visit by train to the Corby works of Stewarts and Lloyds, Limited. On Thursday, at 10 a.m., a lecture on "The Iron and Steel Industry of Sweden" will be given by Mr. Sven Fornander, director of research, Jernkontoret, Stockholm, followed by discussion.

Iron Ore Imports

Iron-ore imports in June, and the total for the first six months of this year compared with the corresponding period of 1954, are shown below.

From	Month ended June 30.	Six months ended June 30.	
	1955.	1954.	1955.
	Tons.	Tons.	Tons.
Sierra Leone	88,061	283,961	335,125
Canada	146,659	361,305	334,847
Other Commonwealth countries and Eire	144	15,426	6,103
Sweden	283,785	2,096,182	1,664,398
France	58,936	234,401	330,832
Spain	88,437	260,683	416,838
Algeria	190,279	1,079,153	1,159,083
Tunisia	81,546	307,737	358,458
French Morocco	23,980	148,834	139,415
French West Africa	57,156	343,386	284,784
Spanish Morocco	21,100	150,725	115,105
Liberia	19,600	126,382	133,070
Brazil	41,625	211,474	209,885
Other foreign countries	58,326	180,427	169,807
TOTAL	1,159,634	5,800,076	5,657,750

Trade in Egypt, Sudan and Ethiopia

Interesting possibilities, but keen competition, are reported by the UK Trade Mission which visited Egypt, the Sudan and Ethiopia in February, and whose report was published last week with a foreword by the President of the Board of Trade. The Mission say that their tour was an extremely valuable experience, and that they found it most illuminating to study at first hand the great changes which have taken place in the last few years in Egypt and the Sudan, and to make better acquaintance with the Empire of Ethiopia. They believe these countries offer interesting markets for the British manufacturer or professional technician with varying, but considerable possibilities. They will repay careful study but should in no case be taken for granted, for in all of them competition is keen. Competitors see, in the shifting political scene, opportunities to oust the UK from her traditional place as the major supplier to both Egypt and the Sudan, while Ethiopia is an open market in which British goods have yet to win special recognition. The delegates are nevertheless convinced that if UK exporters are willing to devote a little extra effort and thought to the changing pattern of the requirements of these countries, they are well placed to maintain a satisfactory volume of business with them.

Notes on the market prospects for a wide range of commodities are appended to the Report, also a coloured contour map of the area covered by the tour, and statistical tables giving balance of payments figures, and showing the comparative position of the UK in each market, both as a supplier and as a customer, with details for the principal commodities.

Peaceful Uses of Atomic Energy

The hopes for world peace centering round Geneva will gain strength from the international conference which is to be held there on the peaceful uses of atomic energy. The United Kingdom is taking part in the conference, which is founded on the proposals put before the United Nations by President Eisenhower, and British scientists will present more than 60 of the many papers to be read. These cover world requirements for power and the role which nuclear energy will play, the building of nuclear-energy enterprises, health and safety aspects, and the production of isotopes.

Giving weight to the events of the conference, which is being held from August 8 to 20, will be two exhibitions running concurrently. The first, in the *Palais de Nations*, is purely scientific and intended primarily for members of delegations. The UK Atomic Energy Authority's display covers 3,000 sq. ft. and will be mainly concerned with nuclear reactors for research and for the generation of power. Models of one of the Calder Hall reactors and of the heavy-water reactors at Harwell—DIDO and PLUTO—now under construction will be exhibited.

DIDO is again featured in the second exhibition in the *Palais des Expositions*, where the AEA is taking 7,000 sq. ft., which is designed for the general public as well as delegates. Here the model will measure 19 by 15 ft. and is 5 ft. 6 in. high. Prominence is again to be given to Calder Hall—a detailed model of the power station will be displayed—and to the breeder reactor experimental power station at Dounreay. Much of the display to devoted to industrial and medical devices for making radioactivity serve man.

Civil Service Scientists

Private industry is not alone in experiencing a shortage of scientists and technologists. The Civil Service, which is easily Britain's largest employer of scientists, is nowadays finding difficulty in filling its senior scientific posts. The list of prominent men in science who have left or are shortly leaving Government service—some to join the ranks of industry—is growing apace, and the task of finding successors of suitable standing is not always easy. To mention only a few, Sir Edward Bullard leaves the National Physical Laboratory in October, and Sir Ben Lockspeiser is soon to leave the Department of Scientific and Industrial Research, while Sir Harold Roxbee Cox resigned as chief scientist of the Ministry of Fuel and Power about a year ago.

Mention of the need of scientists in the Ministry of Fuel and Power, said to be serious enough to hold up the atomic energy programme, was made in the House of Commons during the debate on the shortage of scientific manpower. The National Coal Board had also been desperately short of scientific and technical staff, it was stated.

Outlining the Government's proposals for providing better facilities for scientific and technological education, Mr. Henry Brooke, Financial Secretary to the Treasury, said there had been a tremendous increase in the supply of scientists and engineers since the war. The annual output of graduates and people with Higher National Certificates and equivalent qualifications had gone up from 5,750 before the war to nearly 17,000 last year. The estimated number of graduate scientists in the working population had risen from under 50,000 in 1939 to nearly 80,000 today. There had been an even greater increase in the number of technologists, from a little over 50,000 in 1939 to over 130,000 now.

Government grants for technical education schemes outside London would amount to about £6,000,000 by 1957, declared Mr. Brooke. There would be new major schemes starting in the near future in Birmingham, Sheffield, Newcastle, and Cambridge, and there was a further set of projects constituting the 1956-57 programme now in the planning stage, but which would start next year, at Cambridge, Newcastle, Sheffield, Southampton, and the Manchester College of Technology. These were additional to the programme on which the Government had embarked in an endeavour to meet at university level the new needs which were arising. The development of the Imperial College of Science and Technology in London was likely to cost about £15,000,000.

IT IS POINTED OUT by Midland Silicones, Limited, that the statement on page 71 of the JOURNAL of July 21 that the use of silicones "enables the resin to fall away from the casting cleanly and without any difficulty" may be misleading. In practice, the resin/sand "shell" collapses completely soon after the casting is poured, and no release-agent is required to facilitate this process. The only release problem involved in shell moulding is the stripping of the cured resin/sand "shell" from the patternplate, and it is for this purpose that silicone release-agents are being used. In order to obtain the close tolerances and speed of production claimed for the shell-moulding process, it is essential that the stripping agent should ensure easy and efficient release of the "shell" as well as reducing to a minimum the amount of "build-up" on the patternplate.

CLIFFORD MOTOR COMPONENTS, LIMITED—Mr. S. W. Lewis joins Mr. Cyril S. Joseph as joint managing director. Mr. S. C. Joseph continues as hitherto, but with the title of executive chairman.

Testing Errors*

By G. H. Gardner

In any industrial process it is necessary to carry out tests on raw materials and products. These tests assess the suitability of the materials used and ensure that the product meets the specified standards. They vary in nature and extent according to the process, but they have one thing in common, they must measure the properties with an adequate degree of accuracy. No useful purpose is served if the testing error is greater than the variation allowed for in the specification.

The properties generally assessed are chemical and physical and these two properties are interrelated. The physical properties of a material are generally directly related to the chemical composition, taking into consideration possible heat-treatment and casting conditions.

The general trend is for consumers to demand a higher quality product, made to specification. This is in the interest of foundrymen inasmuch as the consumer is satisfied because he is assured of the suitability of the material and value for his money. It is also beneficial to the foundry industry because it builds up confidence in its products and directly affects productivity and manufacturing costs and profits.

If foundrymen are to obtain consistency in physical properties, *i.e.*, tensile, bend and elongation values, then they must have consistency of chemical composition, whether it be grey iron, mild steel, alloy steel, brass or bronze. However, if the limits of the physical properties are narrow, then the limits of the chemical composition are narrow. This applies particularly where the acceptance or rejection of a batch of castings by a customer depends on a physical test. It then becomes a vital matter to be sure that the results of any chemical tests are within set limits.

Testing errors for chemical testing have usually been measured on a comparative basis. This has mainly taken the form of check tests, by sending the same material to one or more different laboratories. Such a procedure merely establishes that variation in test results exist, but gives no values for the error. It has long been suspected that an undue amount of credence has been placed in test results. Repeat tests frequently give very different values even for the same laboratory and analyst. When this occurs, the question arises as to which is the correct value. This can be answered only on a probability basis supported by further tests. The position is even more difficult when comparing results from different laboratories. It is, in fact, impossible ever to know the correct answer, even with the best testing practice. The most that can be expected is a reasonably close estimate, especially where this is based on an isolated test result. To get such an estimate, one must evaluate one's testing errors. For example, if the casting requires a minimum tensile value of 22 tons per sq in. and an elongation of 15.0 per cent. in a blackheart malleable cast iron, 2.40 to 2.60 per cent. TC and 0.85 to 0.95 per cent. silicon must be used. These may appear to be fairly wide limits of chemical composition, but the obtaining of a silicon analysis value of 0.9 per cent. can give no cause for satisfaction unless the possible error is known. Table I illustrates this point:

TABLE I—*Influence of Analytical Errors.*

Analysed Si per cent.	Limits of error, per cent.	Possible True Si per cent.
0.9	±0.15	0.75—1.05
0.9	±0.10	0.80—1.00
0.9	±0.04	0.86—0.94

Hence one can only be sure of obtaining the correct value if the analysed value taken, together with the limit of error gives final values within the specified range.

Sources of Error

There are three main sources of testing error:—(1) Sampling; (2) test method; and (3) the analyst.

A sample can never give more than an estimate of the bulk properties and there is inevitably a sampling error. The extent of this error depends on the variability of the bulk and the sampling procedure. In the case of chemical testing, there are four stages in sampling procedure, each contributing its own error :—

(1) Sampling the melt, *i.e.*, selecting the tap or the ladle to be tested; (2) sampling the ladle by pouring a test piece; (3) sampling the test piece by drilling, and (4) sampling the drillings for weighing.

The procedure adopted for each of these operations will greatly affect the accuracy of the test results.

A very interesting investigation was carried out recently, by a group of foundries in the United Kingdom. The general object of the investigation was to determine the extent of the errors occurring in routine tests, also to find how these errors varied from foundry to foundry. The investigators hoped to indicate ways in which testing standards could be improved. Tests for total carbon, silicon and tensile were selected as being of greatest practical importance in process and product control.

A group of six foundries was formed to take part in the investigation. They were selected as representing a fair cross-section, and varied widely in type and size. Each of the foundries was supplied with the same standard material both for chemical and physical testing. The foundries were asked to report daily for 30 consecutive days on the

* Short Paper presented to the South African branch of the Institute of British Foundrymen—reported by *Engineer and Foundryman.*

Testing Errors

total carbon and silicon contents of the standard sample supplied. Furthermore, each foundry was supplied with various sets of tensile bars, as cast, and asked to report the strengths obtained under their normal testing conditions. Each set of bars was from a single source and for all practical purposes could be considered identical.

Finally, the groups were asked to sample, drill and test for total carbon and silicon after pulling the tensile bars supplied. Thus the three series covered :—(1) Analysing for TC and Si; (2) tensile testing; and (3) sampling and testing for TC and Si.

It must be understood that the foundries received no indication of the composition of the standard material and agreed that the whole purpose of the work was to find the true level of testing accuracy, this being achieved only by reporting results honestly.

It would then be in the interest of each foundry to examine its own results in the light of the results obtained by the other participants. In this way they could assess their own testing practice and in the interest of those falling below standard could look into the matter for themselves.

The standard sample material used in the first series was supplied by the Bureau of Analysed Samples Limited, covered by the certificate of composition based on the usual referee tests. The material was finely graded and thus homogeneous. This reduced to a minimum the influence of sampling variation on the test results.

A bottle containing 200 gm. of this material was sent to each participating foundry for daily testing. Each test was treated as for a routine foundry sample. The standard value for the material as given by the Bureau was:—Total carbon—3.01, silicon—2.02 per cent.

Actual Results

Table II shows the test results for the standard sample.

TABLE II.—*Test Results on Standard Sample used.*

Foundry No. 1		Foundry No. 2		Foundry No. 3		Foundry No. 4	
TC	Si.	TC.	Si.	TC.	Si.	TC.	Si.
2.82	2.04	2.96	1.97	2.83	1.93	2.90	2.12
2.87	1.96	2.98	1.97	2.81	1.90	2.90	2.08
2.87	2.04	2.95	2.00	2.93	1.96	2.91	2.00
2.86	2.01	2.97	1.97	2.94	1.99	2.89	2.02
2.87	1.98	2.96	1.98	2.90	2.00	2.89	2.02
2.85	1.92	2.99	1.97	2.92	2.00	2.85	2.00
2.80	1.96	2.97	1.96	2.88	2.02	2.87	2.07
2.82	1.93	2.96	1.99	2.82	1.95	2.84	2.06
2.85	1.96	2.97	1.97	2.84	1.92	2.82	2.01
2.73	2.00	2.98	1.97	2.81	1.94	3.00	2.00
2.56	2.00	2.97	1.96	2.79	1.98	2.96	2.00
2.56	1.97	2.98	1.96	2.80	1.97	2.86	1.96

It is interesting to note that carbons reported by foundry 1 show a fall in value during the 30 tests. On exchanging the material reported as 2.55 per cent. TC with foundry No. 5, that foundry also reported a 2.5 per cent. C. There was thus an indication of a progressive change in the sample material during the tests made by foundry 1. It was later discovered that sampling was done by emptying the contents of the bottle on to a sheet of paper and returning the remainder to the bottle. This was done 30 times and there was no doubt that loss of fine graphite occurred. This would account for the drop in carbon.

It will be seen from Table II that while the majority of foundries reported carbon values at the 2.9 to 3.0 per cent. level, there were three foundries reporting consistently at the 2.8 per cent. level. The indication is that the testing gave results 0.2 per cent. low. The general conclusion from the carbon results was that the level of accuracy obtainable from the group was rather low.

It might be questioned whether the true carbon value was exactly 3.01 per cent. as stated by the suppliers. Even if the value were taken at the midway point for the whole group, the significant fact

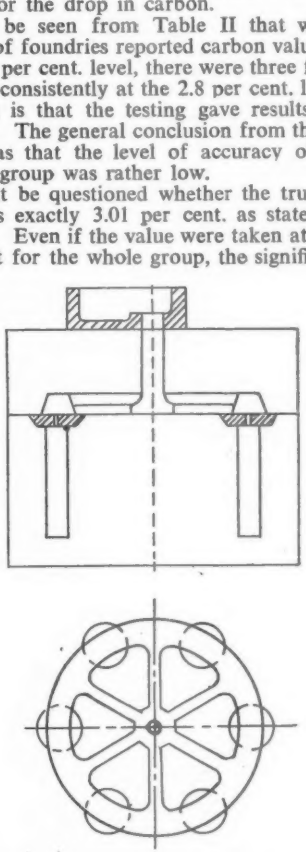


FIG. 1.—*Circular runner showing uniformly dimensioned bars connected to a central downgate.*

would still remain that a given result could have an error of up to ±0.17 per cent.

Of the two elements analysed, the silicon results were nearer standard, both in average values and extent of scatter. Carbon values showed wide fluctuations. There was a preponderance of values below the standard values in both cases. It is evident that the total-carbon results show both a low accuracy of test method and a low degree of precision. Of the two, the test method appears to have contributed the greater degree of error.

A cross-check between foundries was obtained by an exchange of sample bottles after completing the 30 tests. This was done in an effort to ensure that off-standard results were due to testing method

and not to variation in the standard material. The results of this check showed generally that variation was due to method and not to sample.

Tensile Tests

The primary object of section 2(*a*) was to measure the variability between foundries for tensile test results on the same material and aimed at comparing the accuracy of the test method.

The tensile bars for this series were produced by one foundry for each participating group. The bars were cast in oil-sand in groups of six, attached to a circular runner by uniformly dimensioned bars connected to a central downgate. Each tensile bar was placed exactly midway between the connecting runners and was provided with a separate strainer core (see Fig. 1).

The object of this arrangement was to ensure that each bar in the group was cast at as nearly as possible the same temperature and pouring rate. It also gave the same cooling rate for each bar. Thus any variation in tensile from bar to bar of the same group of six could be attributed to testing.

There were in all 18 sets of tensile bars cast (6 bars per set) for each group of foundries. Each 18 sets of the same metal were cast from one ladle at as nearly as possible the same temperature. In this way not only was there the minimum tensile variation among the six bars of the same set, but also among the 18 sets of the same series. This section therefore represented tensile values on one bar for each set of six (Table III).

TABLE III.—*Tensile Tests compared (tons. per sq. in.)*

Foundry No.					
1	2	3	4	5	6
25.2	25.2	26.9	23.8	23.2	22.4
27.0	25.1	16.2*	24.0	26.4	23.6
25.6	26.7	28.0	25.7	22.0	19.4
20.0	24.6	25.0	20.0	25.6	25.5
24.8	20.1	25.9	23.7	*	26.9
27.4	26.1	23.9	19.8	24.8	25.7
Average 25.0	24.6	25.9	22.8	24.4	23.9
Range within foundries 7.4	6.6	4.1	5.9	4.4	7.5

* Defective bar, not included.

In comparing these results it is important to remember that each horizontal row represents test-bars from the same runner. It will be seen that the results give a good indication of the extent of variation from foundry to foundry. The vertical rows are the results within the same foundry.

It is also observed that the range values were extremely high. The mean range for tensile control is set at 2.5 tons per sq. in. This is the permissible day-to-day variation on different heats. The range values obtained on the same material are shown to be from 3 to 8 tons per sq. in.

It can be seen that the mean range value between foundries is consistently higher than the mean range value within foundries. Yet tensile bars between foundries are in each case from the same runner and thus from the same mould. Tensile bars within foundry range are all from different runners. The variation between foundries is thus considerably greater than that within the same foundry.

Comparison of the average values show that the level of test results also vary widely, *i.e.*, from 22.8 to 25.9 tons per sq. in. This variation was obtained not only on the same ladle of metal but on the same casting, since in each of the six rows each foundry tested one bar from the same runner of six bars.

TABLE IV.—*Internal Variation (tons per sq. in.)*

Foundry No.					
1	2	3	4	5	6
19.6	23.6	18.2	23.2	20.0	23.3
19.7	23.5	22.0	23.4	20.8	19.6
18.4*	23.2	22.9	24.2	20.6	21.4
21.0	24.4	23.2	23.0	20.0	20.9
20.8	24.4	22.8	22.8	21.2	22.5
19.2	24.3	22.5	21.8	20.0	22.7
Average 20.1	23.9	22.7	23.1	20.4	21.7
Range 1.8	1.2	1.2	2.4	1.2	3.7

* Defective bar, not included.

From these figures, it can be said that a tensile-test result may be anything from 20 to 28 tons per sq. in. independently of the material, *i.e.*, the result obtained would depend on which foundry did the test and on the level at which that foundry's results happened to be running.

For series 2(*b*) each foundry was supplied with all six tensile bars from the same circular runner. This measured the variation for the same foundry (Table IV).

The average variation between series 2(*a*) and 2(*b*) was practically identical.

The third series of tests was carried out primarily as a check on sampling for chemical testing. It aimed at measuring total sampling and testing errors for carbon and silicon determination. These analyses were done on tensile bars after pulling.

In comparing carbon values for a standard material already drilled and that of tensile bars drilled by individual foundries, it was noticed that there was very little difference between the two. Actually, a slightly lower overall variation occurred in samples drilled by each independent foundry. The conclusion therefore was that the variation was due to chemical analysis. Silicon results obtained from the drilled standard sample and the independently-drilled sample showed the variation to be slightly higher. There appeared to be a definite sampling error for the third series in silicon values. It was probable that this was due to the presence of sand on the casting skin.

Conclusions

(1) The chemical test results showed a considerable variation between foundries and a less, though definite, variation within foundries. In both respects carbon showed a greater variability than silicon. The results indicated that for a material of 3.01 TC findings may range from 2.78 per cent. up to 3.12 per cent. Test results for a material con-

taining 2.02 per cent. silicon may range from 1.85 per cent. to 2.05 per cent. silicon.

(2) The tensile test results showed a serious variation both between foundries and within foundries. Tensile-test results obtained from bars cast from the same ladles, range from 20 tons per sq. in. to 28 tons per sq. in.

(3) A statistical analysis of the test results indicated that for carbon, silicon and tensile, the greater part of the total variation came from the differences between foundries.

From the investigation, therefore, it was found that efforts should be directed toward greater uniformity in testing practice from foundry to foundry.

Inasmuch as considerable variation in testing accuracy was found in this group of British foundries, no doubt the same variation exists in South African foundries. If this be accepted, it is the Author's opinion that great benefit could be derived if a similar investigation could be carried out by local foundries.

Parkistan as a Market for UK Goods

Problems and opportunities created for UK exporters by the great expansion in economic activity which has marked the last four years in Pakistan are outlined in the latest addition to the series of overseas economic surveys (Stationery Office, price 10s.). The author of the survey is Mr. F. B. Arnold, UK Senior Trade Commissioner in Pakistan, who says that the Pakistan Government is determined to put through its long-term development programme, with such foreign aid as it can muster.

The stringent import licensing control which has been in force since 1952 because of Pakistan's overall adverse balance of payments position has stimulated the growth of local industries and has thus affected a section of the market where UK products have held a predominant position. If industrial development brings about an increase in the standard of living, as is hoped, a demand should arise for many classes of goods which at present are denied to the market or are available in insufficient quantities. The key to Pakistan's development, Mr. Arnold points out, is power, and in view of the Government's dependence on overseas countries for heavy electrical plant, the demand for such equipment is likely to be considerable.

Details of the industries in which the Pakistan Government welcomes the participation of foreign capital seeking investment in industry are given by the author, who points out that while the large increase in foreign industrial investment over the past two years has come largely from the UK, the Pakistan authorities claim to have found other countries more forthcoming than the UK—a new phenomenon whose extent cannot be fully gauged yet, but which shows every sign of increasing.

Mr. Arnold says that exporters would be well advised to familiarize themselves with the Government purchasing organizations and their methods of working, and to bear in mind that it is, in general, necessary to have representatives in both East and West Pakistan, divided as they are by a thousand miles of Indian territory. After-sales service facilities and an adequate supply of spare parts for such goods as motor cars, Diesel engines, pumps, etc., are essential.

French Steel Output Up

An increase of 25 per cent. over the comparative 1954 total was recorded in crude steel production in France and the Saar in the first half of this year, when output amounted to 7,881,000 metric tons. The monthly average, at 1,317,000 tons, compares with 1,119,000 tons in 1954.

Home and export orders are being booked at the rate of 900,000 tons a month. Exports to countries outside the European Coal and Steel Community averaged 230,000 tons monthly in the first quarter, and exceeded 300,000 tons in April.

Directory of German Supplies

The second edition (1955) of "German Supplies," published by *Bundesverband der Deutschen Industrie* (*BDI*), the Federation of German Industries, has recently been issued. Justly claimed to be one of the foremost directories of its kind, it has 2,000 pages and contains some 35,000 classified trade headings, covering fully the German exporting industries; it is indispensable alike for importers and manufacturers. It is printed in English, French, Spanish, and German. The directory includes an alphabetical index of German industrial manufacturers; a list of manufacturers of export goods classified according to industrial groups, and an alphabetical directory of German industry with postal and telegraphic addresses, and telephone numbers. Industries covered include:—mining (other than coal); iron and steel manufacture; constructional steelwork; shipbuilding; mechanical engineering; non-ferrous metals; electrical products, and hardware; chemicals and plastics. The directory is by no means confined to heavy industry, there being represented some 42 industries and trades. Copies may be obtained in this country from "Overseas-Post," 16, Sheldon Street, London, W.2 (70s.).

New Standard Samples

Bureau of Analysed Samples, Limited, Middlesbrough, announce the issue of a series of basic-slag samples specially standardized for sulphur by the method of analysis published in BS 1121: Part 29: 1953. The sulphur contents are as follow:—BCS No. 174, 0.16 per cent.; No. 249, 0.29 per cent.; and No. 248, 0.42 per cent. These samples have been prepared for obtaining the empirical factor necessary when determining the sulphur in basic slags by the rapid-combustion process, in connection with slag control in the basic open-hearth process. The analyses were made by the members of the raw-materials, slags and refractories analysis sub-committee of the British Iron & Steel Research Association. The slag samples are packed in bottles containing 25 gm. of each sample and may be obtained direct from the Bureau or through any of the recognized laboratory furnishers.

Venezuelan Iron Ore

In 1954, Venezuela became the largest foreign supplier of iron ore to the United States. Total production was 5,400,000 metric tons. The Orinoco Mining Company is reported to have signed contracts for supplying considerably increased quantities to Europe in 1955 (*e.g.*, 400,000 tons to the United Kingdom and 500,000 tons to Western Germany). A two-year option has now been granted to US interests in respect of the El Trueno deposits.

Magnesium Hazards and their Control

*By Henry Allen**

In no sphere in the foundry is good housekeeping so necessary as in the shops where magnesium is handled, for the explosive and flammable quality of the metal is a marked hazard and there is always the risk of gas-gangrene arising from a particle of magnesium embedded in the skin. Processing and storing magnesium does, in fact, present a major problem in the definition of safe working.

Processing is potentially the most dangerous when magnesium dust is formed, as for instance, when magnesium parts are being ground and cleaned. If the machine is equipped with an emery sanding belt and metal hood, the belt can carry the metal dust from the machine to a collecting vessel, down the sides of which sluices a stream of oil with a flash-point of about 405 deg. F. The oil confines the chips and keeps them from contact with air while the accumulated dust flows into equipment which separates metal from fluid, and passes the scrap into a sump from which it is salvaged. A high flash-point of oil makes for safety in handling and storage.

Safety Policy

There is certainly a marked need to construct and implement a safety policy with magnesium, since the metal can explode, burn or cause metal-fume fever unless handling is safeguarded through the use of an effective code of practice. The explosive risk obtains chiefly when the magnesium had been finely divided into shavings or dust. The fire hazard often lurks in the storage of the metal.

The storage of magnesium is difficult, so that special techniques for safety are imperative. To minimize hazards, it is essential that the metal and its alloys be kept only in areas that are dry, cool and well ventilated. Obviously, magnesium or its alloys must not be kept near any area where there is any possibility of open flame. All bins must be kept covered and labelled with the name of the contents.

As in all accident-prevention work, general co-operation in the practice of safe handling methods must be consistently sought. Many dangers can be eliminated by good housekeeping. It is a sound practice to train machinists of magnesium into the routine of sweeping shavings of the metal at the end of each working shift into specified areas (such as aisles) where the maintenance men can undertake clearance. A covered, colour-coded steel barrel for magnesium should be placed in each department which processes or stores magnesium components. The metal scrap can be placed in the barrel, to be emptied at the end of a shift—and later the scrap can probably be marketed.

The need to label containers with the magnesium content would seem an elementary precaution and yet it is remarkable how many accidents have been caused by failure to implement this policy. One such accident which was reported recently, concerned an employee in the salvage department of a works. An aluminium-turnings container was brought into the department and, believing it to contain only aluminium, the operator whose task it was to sort the salvaged metal put all the contents into a fibre-board drum. Some days later, when he was tamping the material down with a sledgehammer, he noticed an oily rag smouldering in the turnings. When he picked it up it began to blaze, so, dropping it, he fetched a bucket of water and poured it on the rag in the drum. Immediately the contents of the drum exploded, showering the man's head, arms, hands and upper body and causing severe burns. Post-accident investigation showed that the mixture contained both aluminium and magnesium-alloy turnings. How the rag got into the container was not known, but if that hazardous magnesium had been segregated the explosion would not have occurred. Mixing magnesium-alloy scrap with other metals is always to be condemned as a risky business.

If a small explosion and fire does occur with magnesium, blanking off air from the burning metal must be quickly effected and such a technique will rapidly smother the fire. Dry, powdered graphite, asbestos powder, or powdered talc are all to be recommended for this purpose. Water and the majority of other types of standard fire extinguishers should never be used on a magnesium blaze as they will merely have the effect of making the fire more violent.

Additional Precautions

There is much to be done in the way of eliminating unsafe methods in magnesium departments of foundries. Loose, indiscriminate piles of the metal lying in the workshop while waiting to be processed should never be permitted, since it is quite likely that the metal will come into contact with harmful substances or with moisture. Metal which is moist or covered with some gas-forming substance, may generate so much steam or gas on immersion in the molten alloy that an explosion may ensue.

The code of operation should also include methods of breaking the metal and of ladling the molten alloy. Some alloys are friable and do not fracture cleanly so that impact with a breaking tool can cause a mass of tiny particles to be strewn —hazardous to eyes, hands and face. Obviously protective clothing should be worn for jobs of this nature, and employee co-operation in the choice of such kit as goggles and gloves will go far to ensure their regular and scrupulous use.

Magnesium is one of the materials in the foundry which has given rise to considerable comment and suspicion from operators. It can be the cause of spectacular accidents.

* The Author is personnel manager of the British divisions of Yale and Towne Manufacturing Company.

Impact of Strikes on UK Trade

Last month's imports and exports were affected by the rail and dock strikes, but to an extent which, the Board of Trade says, cannot be assessed. It is certain, however, that the trade returns for the next few months will continue to reflect the impact of the strikes. Provisional figures of UK trade in June show that the value of recorded exports was £157,000,000, which was £90,000,000, or over one third, below the April/May average. The fall brought the average monthly rate for the second quarter to 12 per cent. below the first quarter. Recorded imports in June were £293,900,000—only 3 per cent. below the April/May average. The average monthly rate for the second quarter as a whole was 10 per cent. below the first quarter. Total imports in the first half of 1955 were nevertheless 14 per cent. higher than in the first half of 1954.

With re-exports amounting to £8,100,000, the excess of imports valued c.i.f., over exports and re-exports, valued f.o.b., was £128,800,000 in June, compared with an average of £47,900,000 a month in April/May and £77,100,000 a month in the first quarter.

The total of UK exports to North America recorded for June was £17,400,000, a reduction of over one third compared with the average monthly rate of export in April /May. Exports in the second quarter averaged £24,000,000 a month, slightly more than in the first quarter. Exports to the United States during last month amounted to £11,400,000, 19 per cent. less than the April/May average. Exports in the second quarter were 5 per cent. less than January/March. Exports to Canada in June were £6,000,000, which was less than half the average rate of export in the previous two months. Exports in the second quarter were 10 per cent. more than in the seasonally low first quarter.

Prospects for Steel Production

Prospects for production in the steel industry have been somewhat clouded by the interference of the rail and dock strikes. The full extent of the damage they have caused cannot be finally assessed yet, and their effects will still be felt in the coming months. The steel industry's production record for the first half of this year has been marred and the tonnage lost in June, although small—perhaps 120,000 tons of pig-iron and 150,000 tons of steel—cannot be replaced. Output of ingots and castings, which had been above the previous year's level every week until the end of May, inevitably suffered a setback during the difficult month of June.

Before the stoppage there were fair prospects that steel production this year would be appreciably above 19,500,000 tons, against 18,520,000 tons last year, but this no longer seems probable. Producers who kept their mills operating during the stoppage by using up their stocks of semis or pig-iron may be in difficulty until these are replenished. The normal flow of operations disturbed by congestion of undelivered orders even after the return to work may take some time to correct.

Another matter which is threatening on the horizon is the possibility of interruptions in the flow of imported ore. Stocks must be garnered in the summer, because it is impossible to ship from certain ore ports in the winter. The growing need to import coal had already begun to impose a strain on shipping and dock facilities and if more imported coal is needed as a result of the rail strike or if shipping proves to have been seriously dislocated by the dock strike it is likely that the steel industry's ore problem will be intensified.

Imports of Pig-iron and Scrap

Arrangements had already been made before the strikes materialized to increase the import of pig-iron and scrap to well above the 1954 level. As a result, total imports of these materials will probably be of the order of 1,750,000 tons this year, against just over 1,000,000 tons in 1954, and it is reasonable to assume that the steel-melting shops in general will not be short of pig-iron or scrap during the rest of the year. There is bound to be some extra steel import requirement as a result of the strikes.

Imports are divided into those purchased by the industry co-operatively and those brought in by consumers. The former, consisting of ingots and semis for further conversion, in the light of previous events and the strikes themselves, seem likely to be of the order of 800,000 ingot tons. Imports in the second category are less predictable since they depend on the decisions of a host of consumers who will have been affected in different ways by the strikes, but, the British Iron and Steel Federation's " Statistical Bulletin " estimates these will probably not be less than 800,000 ingot tons for the whole year. This would make a 1955 total of around 1,600,000 tons, against 470,000 tons last year. Short export commitments are entered into far in advance of the rate of shipment, the strikes are not likely to have much effect on this year's total exports. But some reduction in the rate is expected because of the interruption in shipments, although in the end the year's total is not likely to differ much from the 1954 figure of 2,890,000 ingot tons.

Allowing for second-hand and reusable material, as well as imports, it is possible that total supplies to the home market this year may reach 18,250,000 ingot tons, against 16,590,000 ingot tons in 1954. If so, the increase in supply over actual consumption last year would be 9 per cent., which compares with a consumption increase of 7 per cent. between 1953 and 1954.

January-June Steel Output a Record

Recently the Iron and Steel Board announced that steel production during the first half of this year totalled 10,074,600 tons, compared with 9,524,200 tons in the first half of 1954. The half-yearly output was a record.

In June, steel production averaged 364,200 tons a week, compared with 371,700 tons in June, 1954. The reduced rate of production that month was, of course, due to the rail and dock strikes. The Iron and Steel Board estimates that the strikes were responsible immediately for the loss of about 150,000 tons of steel and 120,000 tons of pig-iron. But the full adverse effects may not be seen for some time.

Pig-iron production in July averaged 216,800 tons a week; the weekly average in June, 1954, was 233,200 tons.

Latest steel and pig-iron output figures compare as follow with earlier returns:—

Period.	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
	Tons.	Tons.	Tons.	Tons.
1955—May ..	241,800	12,574,000	401,600	20,884,000
June ..	216,800	11,274,000	364,200	18,939,000
Half year ..	235,400	12,242,000	387,500	20,149,000
1954—May ..	231,400	12,033,000	374,500	19,476,000
June ..	233,200	12,129,000	371,700	19,328,000
Half year ..	230,100	11,964,000	366,300	19,048,000

Pig-iron and Steel Production

Statistical Summary of May Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table I summarizes activities during the past six months. Table II gives production of steel ingots and castings in May, and Table III, weekly average production of finished steel. Table IV gives the production of pig-iron and ferro-alloys in May, 1955, and furnaces in blast. (All figures weekly averages in thousands of tons.)

TABLE I.—*Iron and Steel Price Index and General Summary of Pig-iron and Steel Production.*

Period.	Price Index, 1938 = 100.			Iron-ore output.	Imptd. ore used.	Coke to blast-furnaces.	Pig-iron, ferro-alloys prod.	Scrap used in steel prod.	Steel (incl. alloy).			
	I. & S.	Coal.	all comdts.						Imports.[1]	Prod. ingots, castings.	Delivrs. finished steel.	Stocks.[2]
1953	260	350	323	304	207	237	215	188	18	339	262	962
1954—Dec.[3]	267	372	331	301	236	240	234	196	7	355	285	831
1955—Jan.	268	373	333	303	243	240	236	213	11	381	298	828
Feb. ..	269	373	334	315	246	242	242	220	17	394	314	812
Mar.[3]	269	374	331	322	239	244	241	225	28	395	321	808
April	269	374	329	310	234	242	238	224	29	393	311	844
May	269	366	328	313	245	242	242	228	26	402	—	860

TABLE II.—*Production of Steel Ingots and Castings during May*, 1955.

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derby, Leics., Notts., Northants and Essex ..	—	3.5	13.9 (basic)	2.0	0.2	18.6	1.0	19.6
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire	1.7	31.0	—	2.3	0.5	34.1	1.4	35.5
Yorkshire (excl. N.E. Coast and Sheffield) ..								
Lincolnshire	—	40.2	—	—	0.1	40.1	0.2	40.3
North-East Coast	1.2	77.8	—	1.5	0.5	78.9	2.1	81.0
Scotland	3.5	44.1	—	2.0	0.5	48.1	2.0	50.1
Staffs., Shrops., Worcs and Warwick	—	19.2	—	1.2	0.8	19.3	1.9	21.2
S. Wales and Monmouthshire	6.3	78.5	6.2 (basic)	1.2	0.1	91.5	0.8	92.3
Sheffield (incl. small quantity in Manchester) ..	10.1	32.1	—	11.8	0.4	52.4	2.0	54.4
North-West Coast	0.1	1.6	4.9 (acid)	0.5	0.1	7.1	0.1	7.2
Total	22.9	328.0	25.0	22.5	3.2	390.1	11.5	401.6
April, 1955	18.5	327.2	24.5	20.3	2.8	383.0	10.3	393.3
May, 1954	20.1	307.5	24.4	19.1	3.4	363.5	11.0	374.5

TABLE III.—*Production of New Non-alloy and Alloy Finished Steel.*

Product.	1953.	1954.	1954.	1955.	
			April.	March.[6]	April.
Non-alloy steel:					
Ingots, blooms, billets and slabs[4]	4.7	5.1	5.9	4.9	5.0
Heavy rails ..	8.7	9.6	10.1	11.1	10.1
Sleepers, etc. ..	2.2	1.9	1.7	1.7	3.6
Plates, 3 mm. thick and over ..	46.5	47.0	47.0	47.6	48.5
Other heavy prod.	43.9	45.8	47.1	51.8	49.0
Ferro-con. rods, etc.	5.1	5.9	4.8	7.0	7.2
Wire rods and other rods	15.6	19.7	18.6	23.0	23.0
Light rolled prod. ..	44.2	41.2	39.4	48.7	45.1
Bright steel bars ..	6.7	6.3	5.8	8.1	7.6
Hot-rolled strip ..	18.8	21.7	20.9	25.5	24.7
Cold-rolled strip ..	5.2	7.0	6.3	8.2	7.4
Sheets, incl. coated	34.1	38.8	37.8	46.2	44.9
Tin, terneplate and blackplate ..	14.9	16.8	16.3	18.8	16.6
Steel tubes, pipes ..	20.1	20.0	20.4	23.8	21.8
Tube, pipe fit'gs. ..	0.3	0.4	0.4	0.4	0.4
Tyres, wheels axles	4.4	4.7	4.6	4.8	5.3
Forgings (excl. drop forgings) ..	3.1	2.6	2.8	2.6	2.5
Steel castings ..	4.0	4.0	4.1	4.7	4.0
Tool and magnet steel	0.3	0.2	0.3	0.3	0.3
Total	282.8	298.7	294.3	339.2	327.0
Alloy steel	13.7	13.2	12.9	15.7	14.9
Total deliveries from U.K. prod.[5] ..	296.5	311.9	307.2	354.9	341.9
Add: Imported finished steel ..	6.8	5.0	4.0	16.6	18.5
	303.3	316.9	311.2	371.5	360.4
Deduct: Intra-Industry conversion[6] ..	42.6	41.5	40.0	51.3	50.2
Total net deliveries of new material ..	260.7	275.4	271.2	320.2	310.2

TABLE IV.—*Production of Pig-iron and Ferro-alloys during May*, 1955.

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants and Essex	27	—	18.9	27.4	1.2	—	47.5
Lancs. (excl. N.W. Coast), Denbigh, Flints, and Cheshire ..	6	—	13.6	—	—	1.3	14.9
Yorkshire (excl. N.E. Coast and Sheffield) ..	—	—	—	—	—	—	—
Lincolnshire ..	10	—	36.9	—	—	—	36.9
North-East Coast	22	4.8	49.5	—	—	1.4	55.7
Scotland	9	—	15.9	2.6	—	—	18.5
Staffs., Shrops., Worcs., and Warwick ..	7	—	9.8	1.5	—	—	11.3
S. Wales and Monmouthshire	9	4.8	32.0	—	—	—	36.8
Sheffield	1	—	2.2	—	—	—	2.2
North-West Coast	8	16.8	—	0.1	—	1.1	18.0
Total ..	99	26.4	178.8	31.6	1.2	3.8	241.8
April, 1955 ..	98	28.1	175.6	29.4	1.4	4.0	238.5
May, 1954 ..	102	27.6	170.0	28.9	0.8	4.1	231.4

[1] Weekly average of calendar month.
[2] Stocks mainly ingots and semi-finished at the end of the years and months shown.
[3] Five weeks, all tables.
[4] Other than for conversion into any other form of finished steel listed.
[5] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.
[6] Material for conversion into other products also listed in this table.

Book Reviews

Manganese by A. H. Sully, Ph.D., published by Butterworths Scientific Publications Limited, 88, Kingsway, London, W.C.2. Price 41s. post free. (American readers can obtain copies through the Academic Press Inc., 125, East 23rd Street, New York 10.)

If foundry metallurgists who are responsible for casting manganese-bronze or manganese-steel have any curiosity about the remarkable element which permeates their metal, then this is the book for them to consult. It is true that it is full of detail, but some of the details are of great interest. The complex equilibrium diagrams of 45 binary alloys and 22 ternary alloys are discussed, but this does not obscure the fascinating features regarding allotropy and magnetic properties which belong to this metal.

In the periodic table, manganese comes next to the ferro-magnetic elements iron, cobalt and nickel but is itself paramagnetic. We are told that this is because its inter-atomic distances—like those of non-magnetic Y-iron—are too small for a positive exchange energy. When the metal is alloyed with suitable amounts of copper and tin or aluminium then the Mn-Mn distances are expanded, and we get the ferro-magnetic Heusler alloys. Some of these alloys are almost white in colour. As regards allotropy, manganese can exist in four modifications. The brittle alpha form is very complex and contains 58 atoms in the unit cell of structure, and has a Vickers pyramid hardness number exceeding 1,000. This is probably the highest known hardness value for any pure metal but the point is not discussed in the book. The gamma modification, however, is ductile, and has a hardness of about 250. One can electroplate sheet steel with gamma manganese, fabricate it like tinplate, and then let the coating transform to the hard form.

This recalls that electrolytic manganese was first deposited by British researchers in 1923, and a USA firm now produces 7,000 tons per annum of 99.9 purity metal at competitive prices. Steel metallurgy relies on the ferro-alloys, however, and on an average 14 lb. of manganese are used per ton of steel. This amount is rising and is causing some concern, so that both USA and Germany are trying to improve the efficiency of utilization, and to recover manganese from slags and low-grade ores. Production, conservation and recovery are therefore exhaustively discussed in the first three chapters of the work.

The book is beautifully produced and contains hundreds of references to the literature of the subject. It treats of manganese as one of the "rarer" metals, because in the pure form it has not received a great deal of study. H. O'N.

Electric Melting and Smelting Practice by A. G. E. Robiette, M.Sc. Published by Charles Griffin and Company Limited, 42, Drury Lane, London, W.C.2; price 51s. 3d. post free.

The author, who is widely known for his connection with the steelmaking and foundry industry in this country, particularly on the steel-melting side, covers in his book a wide survey of electric-melting furnaces for all types of ferrous and non-ferrous metal.

Electric-arc furnace melting started some 50 years ago and the author describes the changes that have taken place in furnace design and practice since those early days. The versatility and flexibility of the electric furnace is already well recognized and the trend towards large furnaces of the 100-ton type to replace open-hearth units in "cold-metal" shops, is already beginning to find favour in the steelmaking industry.

The author points out the great change that has taken place in arc-furnace practice, *i.e.*, the large increase in power inputs in relation to furnace capacity, 600 kva per ton, being a nominal input. This high input ensures rapid melting which is essential to quality steelmaking. The description of electro-magnetic stirring should be interesting to operators of large arc-furnaces, but there is certain to be some controversy regarding stirring *v.* rabbling.

In the section dealing with the use of oxygen, the author traces this important development in arc-furnace practice since 1946, and shows, in comprehensive form, the saving that can be made by its efficient utilization, particularly in the high-alloy steels of the stainless type.

The chapters on arc furnaces for melting iron are worthy of close study, especially the economics of the process when considered in the light of rising coke, pig-iron and freight charges. It is also possible, that as the tonnage of special irons and s.-g. irons in particular increase, arc furnaces for this application will tend to replace the cupola.

Normal-frequency furnaces, not many of which are operating in this country, are dealt with in a most efficient manner, with adequate diagrams of most of the well-known furnaces as well as operating data and particulars of refractory linings.

The high-frequency induction furnace is fully described and brought up to date; the development of this type of furnace, however, has not been as great as in arc- and normal-frequency furnace development, and it is possible that the life of this furnace will end with the advent of the carbon-resistor furnace, which is capable of steelmaking, as opposed to the very limited amount of steelmaking which can be carried out in the high-frequency furnace.

The book is pleasantly written and contains numerous diagrams and photographs, with an excellent bibliography. It will undoubtedly appeal to the many users of electric furnaces. L. W. S.

New Catalogues

Abrasion and Corrosion Resistant Linings. From Wilkinson Rubber Linatex, Limited, Camberley, Surrey, comes a well presented, except for the front cover, 12-page, well-illustrated catalogue, the major interest in which for foundrymen are the details given as to the use of "Linatex" linings for shot-blast plant. A letter sent to Camberley will ensure a copy being received by readers.

Electric Platform Trucks. Yale & Towne Manufacturing Company, Wednesfield, Wolverhampton, Staffs, in *Bulletin* B1.206 illustrate and describe two models of the "Worksaver." One of these electric platform trucks is of two- and the second of three-tons capacity. This four-page leaflet contains a wealth of data and is available to readers on writing to Wednesfield.

Paints. For the industrialist a catalogue entitled "Pitan" received from Allweather Paints Limited, 36, Great Queen Street, London, W.C.2, is of major interest because it deals with chlorinated rubber paint, which is shown to be well suited for use in conjunction with iron structures. The material is varied to resist acids or alkalis or both. Copies are obtainable on writing to Gt. Queen Street.

WM. GREEN & COMPANY (ECCLESFIELD), LIMITED, Sheffield, ironfounders, have given each of their 260 employees a gift of £10 to mark the firm's centenary.

Clean Air Bill

The text of the Government's Clean Air Bill was published on July 27. It gives effect to the principal recommendations of the Committee on Air Pollution under the chairmanship of Sir Hugh Beaver. The Bill is expected to be debated in the House of Commons in the autumn. The emission of "dark smoke," defined as smoke which is as dark as Shade 2 of the Ringelmann Chart, from any chimney will be prohibited, but the Minister may, by regulation, grant exemptions for specified periods, to cover soot-blowing, the raking of boiler fires, and other operations which unavoidably cause dark smoke for a few minutes.

Defence Points

It will be a defence to prove that the emission of dark smoke was solely due to the lighting-up of a furnace from cold; a mechanical failure which could not reasonably have been prevented; the impracticability of obtaining suitable fuel; or the unsatisfactory nature of the furnace and the impracticability of modifying it at reasonable cost (this last provision will lapse after seven years).

No new furnace (other than a domestic furnace) may be installed unless it is, so far as practicable, capable of being operated continuously without emitting any smoke.

Users of existing furnaces are required to take all practicable steps to minimize the emission of grit and dust. All new furnaces which burn pulverized fuel or solid fuel in big quantities are required to be fitted with equipment to arrest grit and dust.

Local authorities are empowered, by Order, to designate "Smoke Control Areas." In such areas, the emission of any kind of smoke from the chimney of any building (unless specifically exempted) will be prohibited. Such Orders will require confirmation by the Minister.

In a "Smoke Control Area," owners or occupiers of existing private dwellings are to receive grants towards the cost of adapting or replacing their grates and stoves, so as to enable smokeless fuel to be used. The grants will cover not less than 70 per cent. of such approved expenditure. The Exchequer will pay 40 per cent. and the local authority at least 30 per cent. (No grant will be payable in respect of houses built after the Bill comes into force.)

In the case of industrial processes where the prevention of smoke, grit, and dust present special technical difficulties, the duty of supervision will be entrusted to the Government Alkali Inspectorate, instead of the local authority. For this purpose, the Bill extends the operation of the Alkali Act, 1906, to cover smoke, grit, and dust. It will be necessary to add to the list of industrial processes to which the Alkali Act at present applies. This can be done by Order under existing statutory powers.

The general duty of enforcing the provisions of the Bill is placed on local authorities, but they may not take proceedings in respect of an industrial process controlled by the Alkali Inspectorate, except with the consent of the Minister. The maximum fine for offences under the Bill is £100. In the case of a private dwelling, the maximum fine is £10.

The Minister is empowered to appoint the date or dates on which the provisions of the Bill are to come into force. He may appoint different dates for different provisions. Several provisions of the Bill are subject to the qualification "so far as practicable." This is defined as having regard, among other things, to "cost and other financial consequences, to local conditions, and to current state of technical knowledge."

Company News

NOBLE & LUND, LIMITED, machine-tool makers, of Gateshead—The directors have declared an interim dividend of 6 per cent. on the one-class capital of £190,300 in respect of 1955. This compares with a 5 per cent. interim paid on £152,240 for 1954.

WOLVERHAMPTON METAL COMPANY, LIMITED—With group net profits up by some £47,000 at £199,326 for the year ended March 31, 1955, the board is raising the total distribution by the addition of a bonus of 5 per cent. The final dividend recommended is 10 per cent., making, with the 12½ per cent. interim paid before the 50 per cent. scrip issue, the same 18⅓ per cent. equivalent on the present capital as represented by the previous year's 27½ per cent. actual dividend payments. The bonus brings this year's total to the equivalent of 23⅓ per cent.

METAL INDUSTRIES, LIMITED—The trading interests of the operating subsidiaries in the group must have first call on the company's resources, explain the directors in announcing their arrangements for dealing with the 600,000 new shares in the British Oxygen Company, Limited, to which the company is entitled to subscribe as a shareholder. Provisional allotments of 500,000 of the new shares have been placed on "satisfactory terms," and the greater part of the premium obtained will be devoted to the acceptance of the balance of 100,000.

A.P.V. COMPANY, LIMITED, engineers, of London, S.W.18—A rights issue to ordinary shareholders, an offer of £1,500,000 debenture stock to loan stockholders and preference and ordinary shareholders, and repayment of the £650,000 loan stock are announced by the company. A total of 528,620 new ordinary 10s. shares are to be issued at 14s. each. Ordinary shareholders registered on July 15 are offered 492,586 of these shares on a one-for-four basis and may also apply for the balance of 36,034 shares as well as any not taken up by rights. The new shares will not rank for any final dividend for 1954.

GENERAL ELECTRIC COMPANY, LIMITED—Group profits expanded from £8,264,047 to £9,889,324 in the year to March 31 last, and a final dividend of 9½ per cent. on the increased £13,714,680 ordinary stock, against a forecast of 8 per cent., are announced by the company. With the 4½ per cent. interim paid before the "rights" issue of 1,959,240 £1 shares at £2 8s. per share, the year's distribution will amount to £1,040,112 net, compared with the £808,187 taken by the 1953-54 total of 12½ per cent. on the smaller capital. The consolidated net profit attributable to the company after an increased taxation charge, is up by approximately £1,100,000.

Changes of Name

Among companies which have recently changed their names are those listed below. The new titles are given in parentheses.

P.A.S. ENGINEERING, LIMITED, 32/62, High Street, London, E.15 (Wilmer Lea (Machine Tools), Limited).

WILLEN KEY COMPANY (1946), LIMITED, Willen House, Bath Street, London, E.C.1 (Willen Key & Hardware Company, Limited).

REV-O-LOK, LIMITED, manufacturers of and dealers in locks, etc., of 77, Sumner Road, West Croydon, Surrey (Levit Engineering Company, Limited).

CURTIS HOLT (LONDON), LIMITED, dealers in portable tools and engineering materials, etc., of 9, Central Buildings, Southwark Street, London, S.E.1 (Curtis Holt (Bricomi), Limited).

H. & M. INDUSTRIES (LOWESTOFT), LIMITED, manufacturers of machinery and precision and other tools, etc., of Carlton Road, Lowestoft (Carlton Road Engineering Company (Lowestoft), Limited).

News in Brief

THE TRANSFORMER FACTORY of Ferranti, Limited, has despatched three 230,000-volt transformers forming the third 100,000-kva bank for the Garrison Dam project, North Dakota, USA.

A GENERATOR of 20,000 kw is to be supplied by the Metropolitan-Vickers Electrical Company, Limited, for the new power station at Morwell, Victoria, Australia. The contract is worth £A708,000.

THE Federation of Light Metal Smelters states that members' average selling prices for June, to the nearest 10s., have been calculated to be:—L M 1, £183 per ton; L M 2, £185; L M 4, £187; L M 6, £189 10s.

THE APPOINTMENT by R. A. Lister (Marine Sales), Limited, of the Diesel Repair Service, Limited, Brentford (Middx), as spares stockists for all Lister-Blackstone and Lister marine Diesel engines is announced.

Two Belgian steelmaking concerns have been fined a total of B.frs. 1,000,000 (about £7,150) for failing to abide strictly to the price-lists they had filed with the High Authority of the European Coal and Steel Community.

THE EAST KENT ROAD CAR COMPANY, LIMITED, of Canterbury, which already has in service more than 150 of the firm's vehicles, has ordered a further 25 "Arab" double-deck buses from Guy Motors, Limited, of Wolverhampton, for delivery during 1956.

THE BRITISH THOMSON-HOUSTON EXPORT COMPANY has obtained an order, through A.E.I. (India), Limited, worth approximately £300,000 for converting plant, d.c. switchgear, and control gear for the first stage in the main-line electrification of the Eastern Railway of India.

THE 33,000-TON ORE CARRIER Leader, launched by Mrs. I. W. Wilson, wife of the president of the Aluminium Company of America, from the yard of Cammell Laird & Company, Limited, is the largest merchant vessel launched on Merseyside since 1938 and the first of its type to be built at Birkenhead.

A TECHNICAL TEAM may be sent to India by Vickers, Limited, to prepare a project report, if there is a favourable outcome to discussions between the company's deputy chairman, Lord Knollys, and the Indian Ministers of Finance and Commerce on the possibility of setting up capital equipment industries, including cement-making machinery.

T. H. AND J. DANIELS, LIMITED, of Lightpill, near Bristol, are reported to have a helicopter under consideration for carrying their staff from one business place to another. A Bell machine, flown by Capt. John Crewdson, of Rotorfilms, Gatwick, gave a demonstration recently before directors of the firm in a playing field adjoining the factory.

IN A REPORT to the National Joint Advisory Council for Industry, Sir Walter Monckton, the Minister of Labour and National Service, says that in two years' time industry can look forward to an increased supply of young people. The supply will only last for five years, from 1957 to 1962. The number of school leavers will be at its lowest in 1956.

MODERNIZATION AND EXTENSION of the Sunderland works of George Clark (1938), Limited, and the North Eastern Marine Engineering Company, Limited, will cost the Richardsons Westgarth group £400,000. The greater part of the expenditure will take place at George Clark's works, where it is proposed to extend the engine works to allow the company to construct Clark-Sulzer engines up to 16,000 b.h.p.

EFFICIENCY at CEA power stations during the year ended March 31, 1955, accounted for a saving of 750,000 tons of coal, valued at £2,750,000. Three power stations achieved a thermal efficiency of over 30 per cent., with the Portobello, Edinburgh, station returning 31.42 per cent. and leading the field for the second year running. Manufacturers of two turbo-alternator sets with condensing plants and feed-heating systems in service at the Portobello station are Richardsons, Westgarth (Hartlepool), Limited.

SHEFFIELD INDUSTRIALISTS were told by Sir Robert Hadow, Consul General at San Francisco, when he addressed the Sheffield Chamber of Commerce recently, that there was good business waiting for them in new and expanding markets on the west coast of America. He said it would be a good idea for them to get together and send a mobile trade fair over there with samples of Sheffield products. He suggested it should visit the rich centres of California and other places in the West.

THE IRON AND STEEL INSTITUTE are to hold a special meeting in Scunthorpe from Wednesday to Friday, October 12 to 14, at the invitation of the Lincolnshire Iron and Steel Institute. The programme includes technical and social events as well as a number of works visits, one to the steel foundry of Thos. Firth & John Brown Limited, Sheffield. All members, whether resident in the United Kingdom or overseas, wishing to take part in the meeting are asked to complete the forms of registration which should be returned to reach the secretary not later than August 31.

ALEXANDER STEPHEN & SONS, LIMITED, Glasgow, are to build a further two 5,300-ton cargo motorships for the Union Steamship Company, Limited, of New Zealand. This is a duplicate order, as two ships of the same class were ordered from the yard towards the end of 1952. One ship is to be completed this year and the remaining three will follow during 1956. These contracts are a welcome addition to the Clyde order books at a time when there is so much concern over the loss of work to the Continent. Clyde shipyards have done fairly well during the first half of this year, new contracts keeping pace with completions.

A SHIPYARD MODERNIZATION SCHEME, which may cost £400,000, is being put into effect by the Caledon Shipbuilding & Engineering Company, Limited, of Dundee. In his annual statement to shareholders, Mr. Edgar P. Brown, chairman, says that in order to limit the interference with production the scheme may take two or three years to complete. The plans include the construction of a large prefrabricating and welding shed, equipped with cranes capable of lifting up to 30 tons, the installation of new cranes of similar lifting capacity on the building berths, the re-roofing of the main painters' shop, and the widening of existing roads.

SIR HAROLD WEST, managing director of Newton Chambers and Company, Limited, engineers and founders, Thorncliffe, Sheffield, presented the awards at the annual prize-giving day at Pocklington School, Yorkshire, on July 25. He told parents that they should not encourage a son to go into banking "unless he is good at banking, or into insurance unless he is good at insurance." He said leaders were wanted in industry by many of the smaller concerns. A sense of adventure was needed and not so much of the attitude of a good pension at 65. Sir Harold told the boys that they should look upon National Service as nothing but a very fine part of their training for life.

Engineering Recruitment

Few present-day problems in industry have given rise to so much discussion as the shortage of young engineers. Manufacturers up and down the country and numerous trade and technical associations have laboured this theme almost *ad nauseam;* and yet reports of positive action by any of the parties concerned are not nearly as frequent as they should be. It is stimulating, therefore, to learn of progress made in this direction by one of our larger engineering concerns—the Metropolitan-Vickers Electrical Company, Limited.

Metrovick, we are told, is today responsible for training some 2,700 men, women, youths, and girls through its education department, which was established nearly 40 years ago. There are over 10,000 names on the company's register of apprentices and trainees, and many of these now hold high positions, not only with the company, but throughout industry in the UK and abroad. Seven of the executive directors on the company's board are ex-apprentices and 70 per cent. of the heads of departments were trained in the Trafford Park works.

Each year the company recruits about 80 graduates for training from home universities, and professional engineering apprenticeships are available for public school and grammar school boys who leave school from the ages of 16 to 19. Yet the company is still wide awake to the threat to industry of the shortage of engineering recruits, as is witnessed in a recent speech by Dr. Willis Jackson, the organization's director of research and education. Dr. Willis pointed out that there was a 30 per cent. discrepancy in the engineering industry between the demand and supply of suitable graduates, in spite of the fact that since 1950 the universities had more than doubled their output. A disturbing feature of the situation, he said, was that since 1951 the entry into university schools of engineering had not increased.

One cannot but feel that a few more schemes such as that run by Metrovick, plus the eradication of the idea widely held in our schools that only second-rate pupils should enter engineering, would go a long way towards solving this difficult problem.

Restrictions on Hire-purchase

An Order amending the Hire-Purchase and Credit Sale Agreements (Control) Order, 1955, has been made by the Board of Trade, following the statement by the Chancellor of the Exchequer in the House of Commons last week.

The main change is the increase in the minimum initial deposit from 15 to 33⅓ per cent. of the cash price for certain classes of goods. The maximum periods of payment of the balance are unchanged.

The classes of goods for which the deposit is increased to 33⅓ per cent. include radio and television sets, washing machines, vacuum cleaners, refrigerators, cars, and motor-cycles. Goods for which the deposit remains at 15 per cent. include domestic furniture, cookers, water heaters, wash boilers, and pedal cycles.

Agricultural buildings and greenhouses and equipment for certain ships are now excluded from the Order, which came into force on July 26. Copies of the amended Order may be obtained from the Stationery Office (3d.).

SHORT BROS. & HARLAND, LIMITED—Sir James H. Barnes, until recently Permanent Under-Secretary of State for Air, has been appointed a director.

Vertical Ladder Blamed

A claim against Prince, Smith and Stell, Limited, textile-machinery makers, Bradford Road, Keighley, for damages in respect of injuries received by a workman was heard by Mr. Justice Cassels at Leeds Summer Assizes on July 19. Thomas O'Leary, yard labourer, of Keighley, claimed damages in respect of injuries received in an accident at the works in 1954. On the day in question he was said to have returned to work after three months' illness, and as a result of the accident went to hospital and did not return to work until November 14.

It was stated that O'Leary was climbing a vertical, fixed metal-ladder leading to a platform from which he could get into a travelling crane, when he caught his foot on a bracket behind the ladder. He fell about 13 ft. on to a pile of chains and his leg was broken. The company suggested that a faulty handhold by O'Leary himself when about to reach the platform, had led to the mishap. A meeting of the works' safety committee the same day referred to the accident but did not mention the bracket. This committee was concerned with improvements and had made alterations to the hand-rail and the platform and in the rake of the ladder.

The fact that the ladder was a vertical one was of great importance, said the judge. Mr. O'Leary had found his foot caught suddenly, as in a vice, as he was in the act of completing his ascent and seeking a hand-hold. The judge thought it was an unreasonable arrangement. He thought Mr. O'Leary was an individual upon whom he could place reliance. According to the agreed medical report he had made a satisfactory recovery from his injury. Damages of £480, including special damages agreed at £180, with costs, were awarded to claimant.

Long-period Dust Sampler

For routine sampling of airborne dust, the scientific department of the National Coal Board, according to *Science Bulletin No.* 4, has developed a portable long-period respirable dust-sampling instrument, designed to operate unattended and independent of any external power at the coal face over a full working shift of 8 hrs. In construction, it consists of a sampling head, a clockwork-driven pump which breathes to and fro through the sampling head, and an alkali battery to supply the heating current for the thermal-precipitation process. A clock dial indicates the running time and hence the volume of air "inhaled" during a sampling period.

The respirable dust particles are collected on a single microscope slide by a combination of gravity settlement and thermal precipitation. Before the dust-laden air reaches the collection area, it passes through a horizontal duct in which the larger particles settle. The removal of particles in this duct simulates the action of the human nose and throat; and only those particles which would be deposited in the lungs are collected for later examination. The respirable dust is collected over an area half-an-inch square; the larger, fast-falling particles settle first leaving only the finest dust, smaller than 2 to 3 microns, to be precipitated on the portion of the slide below the heated element.

The evaluation of the dust collected is at present carried out by microscopy, but work is in progress to develop an automatic photo-densitometric technique.

Personal

DR. F. L. GILBERT has resigned from the board of Catalin Limited.

MR. C. D. MILLER has been appointed a director of the Sturtevant Engineering Company, Limited.

MR. W. M. LARKE, works manager of Stewart and Lloyds, Limited, Bilston, has left for a visit to Australia.

ADMIRAL SIR MAURICE MANSERGH has been appointed a director of the Anti-Attrition Metal Company Limited.

MR. E. BRUCE BALL, formerly managing director of Glenfield & Kennedy, Limited, has been appointed an additional director of Metal Industries Limited.

Mr. MILNER GRAY has been elected Master of the Faculty of Royal Designers for Industry and will hold office for two years. He is 56 and succeeds Sir FRANCIS MEYNELL.

MRS. F. MORRIS, the widow of the founder of B. O. Morris Limited, Coventry, has resigned from the board. She has been associated with the company since its incorporation in 1937.

Mr. W. FISHWICK, Lecturer in Electrical Engineering at Edinburgh University, has been appointed to the newly-established Chair of Electrical Engineering at the University College of Swansea.

Sir PATRICK DOLLAN, chairman of the Scottish Fuel Efficiency Committee, has been reappointed a part-time member of British European Airways Corporation for a period of one year from June 1 last.

Mr. ERNEST F. THOMPSON, works manager of the Dowlais (Glam) factory of the Small Heath group of the B.S.A. Company, Limited, has been appointed works manager of the Redditch (Worcs) factory, including the B.S.A. precision-casting foundry.

Mr. ARTHUR DAVIES has joined the staff of John I. Thornycroft & Company, Limited, engineers and shipbuilders, of Cowes (I.o.W.), as technical sales representative to handle the sales of oil-fuel burning gear for marine and industrial purposes.

SIR PERCY H. MILLS has become chairman of W. & T. Avery, Limited, following the resignation of Sir Walford H. Turner. Sir Walford, who has also resigned from the board, was a director of the company for 36 years and chairman for 15 years. Mr. Austin Morley has been appointed managing director.

Mr. BARRY KAY, Board of Trade and Ministry of Supply Controller for the Midland Region, has been appointed to succeed Mr. C. S. TOSELAND, who is retiring from the public service on September 1, as Controller for the London and South Eastern Region. Mr. Kay will be succeeded at Birmingham by Mr. A. N. HALLS.

BABCOCK & WILCOX, LIMITED, announce the retirement of MR. J. SMITH, M.I.MECH.E., from the position of managing director of Edwin Danks & Co. (Oldbury), Limited, he has been appointed deputy chairman of the company. MR. L. W. H. REA, whose appointment as general manager of Edwin Danks had been previously announced, has been appointed to the managing directorship.

Sir ARNOLD HALL, who has been Director of the Royal Aircraft Establishment, Farnborough, since 1951, has resigned the post to join the board of the Hawker Siddeley group as technical director on November 1. Sir Arnold, who is 40, is succeeded at Farnborough by Mr. G. W. H. GARDNER, at present Director-General of Technical Development (Air) in the Ministry of Supply, who is 52.

GOODWIN BARSBY & COMPANY, LIMITED, a member of the Aveling-Barford group—announce that commencing this month their London manager is Mr. F. J. CLAY. Mr. Clay first came to the firm in 1919 and has been on the sales staff for a number of years. The new London office address is at Morris House, 1/5 Jermyn Street (tel.: Whitehall 0527), and the new Scottish office address is at 49 Shieldhall Road, Glasgow, S.W.1 (tel.: Govan 2888).

The British Thomson-Houston Company, Limited, announces the retirement—after 36 years' service with the company—of Mr. C. A. MARTIN, who has been its consulting engineer since 1939. His successor is Mr. G. M. MCILWRICK, who joined the company's d.c. engineering department in 1929. Subsequently he was in charge of all large d.c. machine design. Mr. McIlwrick designed the first 10,000-amp., 3,500-kw. generator for electrolytic work and he has also done much work on the development of electrical drives for steelworks. In his new appointment he will take over Mr. Martin's work on standardization, committee representation, and interchange of information. Mr. McIlwrick has been elected to the British National Committee of the International Electrotechnical Commission.

Obituary

Mr. HENRY BERNARD BAMFORD, chairman of Bamfords, Limited, agricultural engineers, of Uttoxeter (Staffs), died recently at the age of 80.

The death has occurred of Mr. DAVID GRAY-FRASER, who was manager of the Dalziel Steelworks, Motherwell, of Colvilles, Limited, for some time after the first world war.

Mr. ROLAND H. HUDSON, London area manager of John Holroyd & Company, Limited, machine-tool makers, etc., of Milnrow (Lancs), has died while on holiday in Majorca.

Mr. GEORGE ELLISON, who died last week at the age of 82, was chairman of George Ellison, Limited, engineers and switchgear makers, of Birmingham, Tufnol, Limited, makers of insulating materials, of Birmingham, and Alfred Ellison, Limited. He founded the Ellison group of companies in 1903 and at one time held the position of chief engineer of the Paris tramways.

The Constructional Engineers Union had supported a man's claim for accident compensation at the Assizes at Leeds but the case was lost and the man was left to pay the costs of the action. This was told to Judge R. C. Essenhigh at Rotherham County Court on July 19, when George H. Sharpe, of Rotherham, was ordered to pay costs owing to the United Steel Companies Ltd., at the rate of £1 per month. Sharpe's case for compensation was taken to the Leeds Assizes by the Union but the action failed. Sharpe explained to the judge at Rotherham that he nearly lost his life in a works accident. "I was off work for 13 weeks and heard nothing else about it for three years until a short time ago when I got a summons for £50," he said. Judge Essenhigh said, "Some unions would shudder at this kind of thing." Mr. Robert Elmhirst, representing United Steel Companies, said Sharpe's predicament was appalling, and offered to get in touch with the Union on his behalf.

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FS 14

Raw Material Markets

Iron and Steel

Because of holidays, production at most of the foundries is now at a low ebb. From foundries in the Birmingham and Staffordshire areas, for instance, there has been a mass exodus of holidaymakers and work will not be fully resumed until Monday. The holiday period provides an opportunity of carrying out major reconstructions and such repairs and renewals to plant and machinery as may be found necessary, so that uninterrupted production may continue on the resumption of work.

Although most of the foundries have full order-books, the future is not as secure as they would like it to be.

Apart from the recent increases in pig-iron prices, the foundry trades have to bear the advance in the price of foundry coke which took place on July 18, and prices of other materials which they use, including scrap, limestone, ganister, etc., have also recently been increased to cover higher wages, freight charges, and other costs. The accumulative result of these increases is bound to raise the price of castings, and consumers, particularly those engaged on the production of motor vehicles, plant, and machinery, etc., for the export market, are much concerned, as competition from other countries is strong.

The light foundries producing castings for refrigerators, gas cookers, and other items of domestic equipment will, it is feared, have a further setback if prices are increased. Already credit restrictions have had an adverse effect on their trade, and increased prices, coupled with the recent additional restrictions on hire-purchase transactions, may result in fewer purchases still.

However, at the moment order-books at most of the foundries are good, with the engineering and speciality foundries heavily engaged. Their chief concern at present is to secure adequate supplies of raw material, particularly pig-iron, their requirements being chiefly the low- and medium-phosphorus grades of iron and hematite.

Many of the engineering and speciality foundries made arrangements to accept deliveries during the holiday period, as they are anxious to secure the largest tonnages available as supplies will permit.

Foundry coke is coming forward fairly satisfactorily, although deliveries of some grades of Welsh coke are still behind the allocated tonnages. Ganister, limestone, and firebricks are received to requirements. The demand for heavy cast-iron and machinery scrap is strong, and parcels arising are at once taken up by ready buyers.

Anxiety regarding the maintenance of deliveries of billets and sheet bars to the re-rolling and sheet mills persists.

For some time past the flow of material has been precarious, and although British steelmakers have recently been able to provide slightly increased tonnages, this improvement is apparently due to temporary stoppages of the rolling mills. Present indications are that supplementary tonnages of imported material will be needed for some time to come, and these are not readily obtainable.

In the finished-steel trade order-books are still congested and rollers of sheets and heavy steel products in the form of plates, joists, and sections are fully sold to the end of the year. Business is consequently at a low ebb and it is not yet possible to assess the effect of the steep rise in prices which came into effect last month.

Non-ferrous Metals

Copper prices fell away in London at the end of last week after touching record levels in the first half. Values at the close on Friday stood at £361 for cash and £354 for three months, but these quotations showed gains on the week of £6 and £6 10s. in the respective positions.

Some attempt to fill the gap caused by the copper strike in the United States has been made by shipments of copper from the UK, but such contributions are probably not of very much account against the background of loss of output in America.

Bullish sentiment regarding the copper price outlook was strengthened further last week by a short-lived strike at the Chuquicamata property in Chile. To this had to be added the troubles of the European mineworkers in Northern Rhodesia, but at the weekend reports from the Federation indicated that the Anglo American group of companies had signed an agreement with the union which, according to the chairman, Sir Ernest Oppenheimer, as far as his group was concerned, ended the deadlock on African advancement in the copper-mining industry.

For the first time since its scheme was launched 12 weeks ago, the Rhodesian Selection Trust has raised its fixed price for copper. The new price of £325 a ton, an advance of £45 came into effect on Tuesday and must remain unchanged for a minimum of 30 days.

In spite of possible setbacks in the LME price, one of which should come with the settlement of the US trouble, the outlook over the rest of this year is for a tight position in supplies of electro.

The zinc market was rather disappointing last week, for there was a steady downward drift which took the quotation for second half July down to £89 5s., a loss of £2 on the previous Friday, while second half October fell by £1 15s. to £90. These were the lowest prices seen for some time and question the belief that the price in the States will shortly advance to 13 cents. Across the Atlantic the statistical position, however, is quite good, thanks to persistent stockpiling, and it may well be that the quotation will advance.

Lead was steady in London, rising by 10s. for July, but unchanged October. Trading in tin was fairly quiet, price changes on balance amounting to a fall of £4 in cash and of £3 in three months.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* July 28, £364 to £364 10s.; July 29, £360 10s. to £361; August 2, £359 to £360; August 3, £360 10s. to £361.

Three Months: July 28, £357 to £358; July 29, £353 10s. to £354; August 2, £351 to £352; August 3, £353 to £353 10s.

TIN, Standard—*Cash:* July 28, £763 to £764; July 29, £760 to £762; August 2, £760 to £761; August 3, £763 to £765.

Three Months: July 28, £756 to £757; July 29, £754 to £755; August 2, £753 to £754; August 3, £757 to £753 10s.

LEAD—*Second half July:* July 28, £107 5s. to £107 10s.; July 29, £107 10s. to £107 15s. *First half August:* August 2, £107 15s. to £108; August 3, £107 15s. to £108.

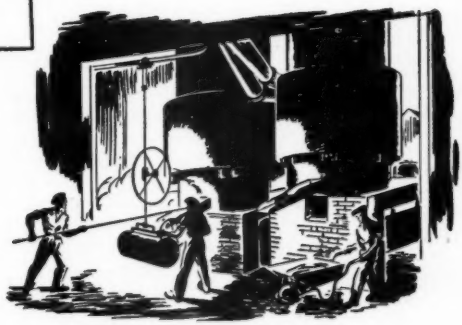
Second half October: July 28, £107 to £107 5s.; July 29, £106 15s. to £107. *First half November:* August 2, £107 5s. to £107 10s.; August 3, £107 to £107 5s.

ZINC—*Second half July:* July 28, £89 to £89 10s.; July 29, £89 to £89 5s. *First half August:* August 2, £90 5s. to £90 10s.; August 3, £90 15s. to £91.

Second half October: July 28, £90 5s. to £90 10s.; July 29, £89 15s. to £90. *First half November:* August 2, £90 10s. to £90 15s.; August 3, £91 to £91 5s.

WHO USES FULBOND?

—Foundrymen who want to strengthen natural sand



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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

August 3, 1955

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £17 1s. 0d.; Birmingham, £16 13s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £18 12s. 9d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £19 8s. 3d.

Scotch Iron.—No. 3 foundry, £19 5s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £21 3s. 0d.; South Zone, £21 5s. 0d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £22 0s. 0d.; South Zone, £22 3s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £19 5s.; Scotland (Scotch iron), £19 11s. 6d.; Sheffield, £20 12s. 0d.; Birmingham, £20 19s. 6d.; Wales (Welsh iron), £19 11s. 6d.

Basic Pig-iron.—£16 16s. 6d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent., Si, £40 15s. 0d., scale 15s. per unit; 75 per cent., Si, £63 0s. 0d., Si, scale 16s. per unit.

Ferro-vanadium.—50/60 per cent., 23s. 8d. to 25s. 0d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 11s. 0d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £230 0s. 0d. per ton; 38/40 per cent., £279 0s. 0d. per ton.

Ferro-tungsten.—80/85 per cent., 17s. 6d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 20s. 6d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent. C, £83 0s. 0d. to £86 0s. 0d., basis 60 per cent. Cr, scale 25s. 0d. per unit; over 6 per cent. C, £81 0s. 0d. to £84 0s. 0d., basis 60 per cent. Cr, scale 24s. 0d. per unit; 2 per cent. C,* 1s. 11½d. per lb. Cr; 1 per cent. C,* 2s. 0d. per lb. Cr; 0.15 per cent. C,* 1s. 11d. to 2s. 1d. per lb. Cr; 0.10 per cent. C,* 1s. 11d. to 2s. 2d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 0d. to 7s. 6d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £249 0s. 0d. per ton; 96/98 per cent., £269 0s. 0d. per ton.

Ferro-columbium.—60/75 per cent., Nb + Ta, 37s., per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £53 17s. 6d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £26 19s. 0d.; tested, 0.08 to 0.25 per cent. C, £27 19s. 0d.; hard (0.41 to 0.60 per cent. C), £29 5s. 6d.; silico-manganese, £36 7s. 6d.; free-cutting, £31 0s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £34 12s. 0d.; silico-manganese, £36 7s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £31 11s. 0d.; basic, hard, over 0.41 up to 0.60 per cent., C, £32 13s. 6d.; acid, up to 0.25 per cent. C, £35 12s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £33 1s. 6d.; boiler plates (N.-E. Coast), £35 11s. 6d.; floor plates (N.-E. Coast), £34 10s. 6d.; sectional material, N.-E. Coast, £30 19s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £33 19s. 6d.; flats, 5 in. wide and under, £33 19s. 6d.; hoop and strip, £35 1s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £36 5s. 0d.; black sheets (hand mill), 17/20 g., £46 13s. 6d.; galvanized corrugated sheets, 24 g., £54 14s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £58 0s. 3d.; nickel-chrome, £81 10s. 0d.; nickel-chrome-molybdenum, £92 7s. 6d.

NON-FERROUS METALS

Copper.—Cash, £360 10s. 0d. to £361 0s. 0d.; three months, £353 0s. 0d. to £353 10s. 0d.; settlement, £361 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 3s. 5½d. per lb.; rods, 408s. 6d. per cwt. basis; 20 s.w.g., 441s. 9d. per cwt.

Tin.—Cash, £763 0s. 0d. to £765 0s. 0d.; three months, £757 0s. 0d. to £757 10s. 0d.; settlement, £765 0s. 0d.

Lead (Refined Pig).—First half August, £107 15s. 0d. to £108 0s. 0d.; first half November, £107 0s. 0d. to £107 5s. 0d.

Zinc.—First half August, £90 15s. 0d. to £91 0s. 0d.; first half November, £91 0s. 0d. to £91 5s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £120 0s. 0d.; rolled zinc (boiler plates), all English destinations, £117 15s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £103 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 2s. 9d. per lb.; rods, drawn, 3s. 6⅛d.; sheets to 10 w.g., 352s. 0d. per cwt.; wire, 3s. 4¼d.; rolled metal, 337s. 9d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £224; B6 (85/15), —; BS249, —

Brass (High Tensile).—BS1400, HTB1 (30 tons), £272; HTB2 (38 tons),—; HTB3 (48 tons),—.

Gunmetal.—RCH, 3/4 per cent. tin, —; BS1400, LG1 (85/5/5/5), £306; LG3 (86/7/5/2), £315; G1 (88/10/2/½), £386; (88/10/2/1), £375.

Phosphor Bronze.—BS1400, PB1 (AID released), £406 per ton.

Phosphor Bronze Strip, etc.—Strip, 494s. 0d. per cwt.; sheets to 10 w.g., 517s. 6d. per cwt.; wire, 5s. 0½d. per lb.; rods, 4s. 4½d.; tubes, 4s. 3d.; chill cast bars: solids 4s. 5d. cored 4s. 6d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 4s. 3d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 7½d.; special quality turning rod, 10 per cent.; ½ in. dia., in straight lengths, 4s. 6½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 4d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £108 0s. 0d. Nickel, £519 0s. 0d. Aluminium, ingots, £171 0s. 0d.; aluminium bronze (BS1400), AB1, £352; AB2, £369. Solder, brazing, BS1845, 2s. 11d. lb.; granulated, 3s. 3d. lb.

* Average 68-70 per cent.

New Patents

(Copies of complete specifications are obtainable from the Patent Office Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3/-.)

732,412. Knut Ingvar Hurtig, 35, Tomtrattsvagen, Hagersten, Sweden.

A bottom-board for foundry flasks which comprises a thin-gauge corrugated metal sheet supported on a load carrying structure at a large number of points distributed over its underside. The channels formed by the corrugations on the upper surface of the sheet provide venting to the atmosphere.

732,518. Steinkohlenbergwerk, Hannover-Hannibal Aktiengesellschaft, Bochum-Hordel, Germany.

A formed coke for foundry shaft-type furnaces, having a unit size of 350-600 cm. for furnaces up to 800-mm. dia. and 600-1,000 cm. for furnaces above 800-mm. dia. The coke is of regular form, *e.g.*, spherical, oval or cubic, and has a porosity of 30-35 per cent. in small size and 35-40 for larger size. It consists of 80-90 per cent. high-temperature fine coke, the rest being coke from tar or tar-like substances.

732,712. Miag Muehlenbau und Industrie, G.M.b.H., of Planckstrasse 2, Hanover, Germany.

A process for the manufacture of cast iron of high tensity and low extensibility. As the desired wall thickness of the article to be cast varies from 100 mm. down to 2 mm. so the silicon content increases from 0.2 to 1.2 per cent of the melt, and the carbon content decreases from 4.5 to 4 per cent.

732,728. Sterling Foundry Specialties, Limited, Iddesleigh House, Caxton Street, London, S.W.1, and J. G. W. Lowe, 45, Kimbolten Road, Bedford.

An improved type of tubular and sectional scaffolding. An appertured or slotted clamping plate or clip is positioned to engage a stud (which cannot be separated from the work and thus dropped), and clamped upon the end(s) of cross braces passed over the stud.

732,747. Deutsche Edelstahlwerke, Aktiengesellschaft, 578 Gladbacherstrasse, Krefeld, Germany.

This patent refers to equipment for the production of hollow cores. It comprises a container for sand-resin mixture under atmospheric pressure, a ladle carried by a rocker arm and a blower head. The arm is rockable so that the ladle can move through and pick up a charge of sand mixture. A pressure medium is introduced through the blower head into the ladle so that the mixture can be blown from the ladle into a heated core box arranged to receive it.

732,755. Eisenwerke Mulheim-Heiderich AG., Friedrich-Ebert Strasse 98 to 100, Mulheim/Ruhr, Germany.

A method of casting iron in chill moulds. The heat radiation of the chill mould is delayed by surrounding the chill mould with a jacket of material of low conductivity.

732,862. Buders'sche Eisenwerke, 52 to 56, Sophienstrasse, Wetzlar, Germany.

A centrifugal casting machine which has a mould mounted on a non-rotating mould carrier, *e.g.*, in a housing for cooling water where the mould is provided with an annular bearing. This bearing surrounds the mould at the point along the mould at which the mould is driven to rotate it. This bearing also resists both axial and radial forces and prevents movement of the mould from its central position.

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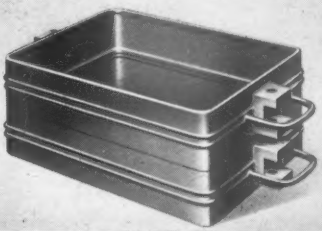

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